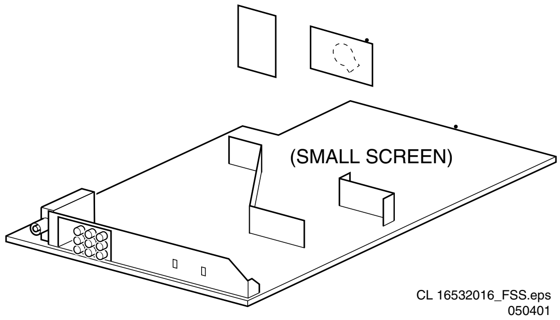
# L8
## AB

Service
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Service




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# Service Manual

**Contents** **Page**





Published by RB 0264 Service PaCE Printed in the Netherlands Subject to modification EN 3122 785 12760

PHILIPS

# 1. Technical Specifications, Connections and Chassis Overview

## 1.1 Technical Specifications

### 1.1.1 Reception

| | | |
|---|---|---|
| Tuning system | : | PLL |
| Color systems | : | NTSC M (3.58 - 4.5 MHz) |
| Sound systems | : | FM-mono M (4.5 MHz) |
| | : | BTSC DBX (4.5 MHz) |
| A/V connections | : | NTSC M (3.58 - 4.5 MHz) |
| Channel selections | : | 181 channels, full cable |
| IF frequency | : | 45.75 MHz |
| Aerial input | : | 75 Ω, Coax |

### 1.1.2 Miscellaneous

| | | |
|---|---|---|
| AC voltage | : | 90 - 140 V (± 10 %) |
| AC frequency | : | 60 Hz (± 5 %) |
| Ambient temperature | : | + 5 to + 45 deg. C |
| Maximum humidity | : | 90 % |
| Power consumption | : | 36 W (14") 100 W (32") |
| Standby Power consumption | : | < 3 W |

## 1.2 Connections

### 1.2.1 Front Or Top Control, Front Or Side Connections

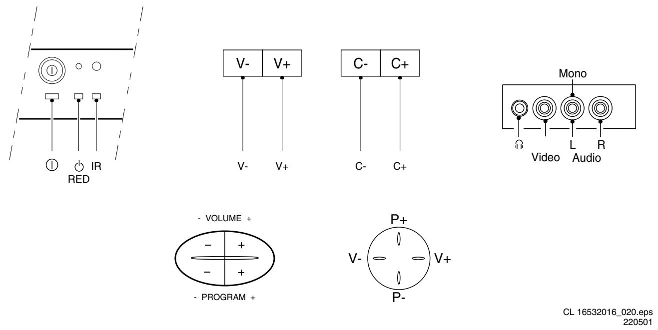



**Figure 1-1**

***Audio / Video In***

| | | |
|---|---|---|
| 1 - Video | 1 Vpp / 75 Ω | |
| 2 - Audio | L (0.2 Vrms / 10 kΩ) | |
| 3 - Audio | R (0.2 Vrms / 10 kΩ) | |
| 4 - Headphone (3.5 mm) | 8 - 600 Ω / 4 mW | |

### 1.2.2 Rear Connections

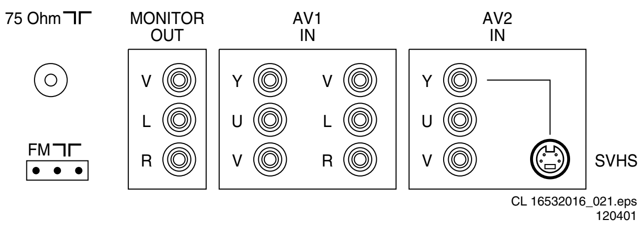



**Figure 1-2**

***Monitor Out***

| | | |
|---|---|---|
| 1 - Video | 1 Vpp / 75 Ω | |
| 2 - Audio | L (0.5 Vrms / 1 kΩ) | |
| 3 - Audio | R (0.5 Vrms / 1 kΩ) | |

***YUV In***

| | | |
|---|---|---|
| 1 - Y | 0.7 Vpp / 75 Ω | |
| 2 - U | 0.7 Vpp / 75 Ω | |
| 3 - V | 0.7 Vpp / 75 Ω | |

***AV1 In***

| | | |
|---|---|---|
| 4 - Video | 1 Vpp / 75 Ω | |
| 5 - Audio | L (0.5 Vrms / 10 kΩ) | |
| 6 - Audio | R (0.5 Vrms / 10 kΩ) | |

***AV2 In***

| | | |
|---|---|---|
| 1 - Video | 1 Vpp / 75 Ω | |
| 2 - Audio | L (0.5 Vrms / 10 kΩ) | |
| 3 - Audio | R (0.5 Vrms / 10 kΩ) | |

***AV2 In (SVHS)***

| | | |
|---|---|---|
| 1 - | gnd | |
| 2 - | gnd | |
| 3 - Y | 1 Vpp / 75 Ω | |
| 4 - C | 0.3 Vpp / 75 Ω | |

## 1.3 Chassis Overview

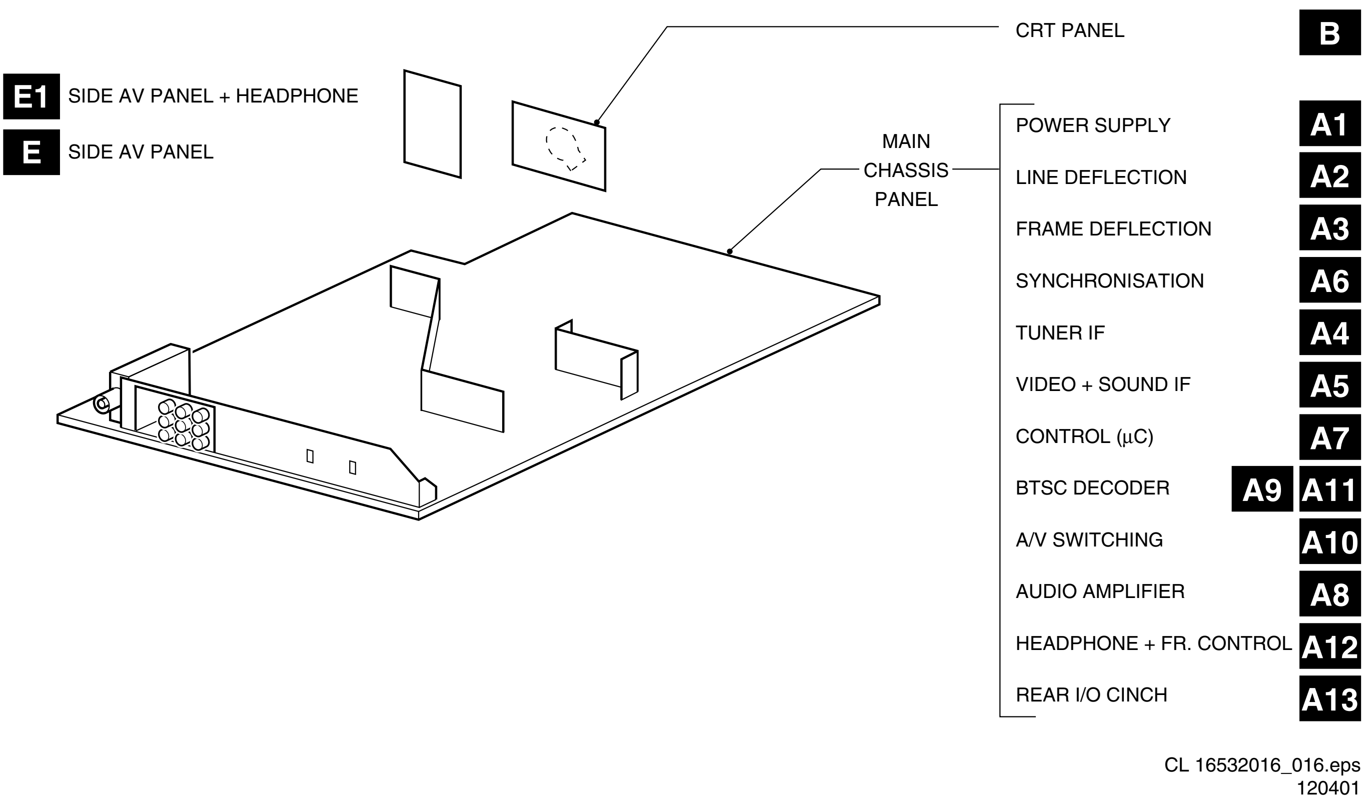



**Figure 1-3**

# 2. Safety & Maintenance Instructions, Warnings, And Notes

## 2.1 Safety Instructions For Repairs

Safety regulations require that during a repair:

- Due to the ‘hot’ parts of this chassis, the set must be connected to the AC power via an isolation transformer.
- Safety components, indicated by the symbol ▲, should be replaced by components identical to the original ones.
- When replacing the CRT, safety goggles must be worn.

Safety regulations require that after a repair, the set must be returned in its original condition. Pay particular attention to the following points:

- General repair instruction: as a strict precaution, we advise you to re-solder the solder connections through which the horizontal deflection current is flowing, in particular:
  – all pins of the line output transformer (LOT)
  – fly-back capacitor(s)
  – S-correction capacitor(s)
  – line output transistor
  – pins of the connector with wires to the deflection coil
  – other components through which the deflection current flows.

Note: This re-soldering is advised to prevent bad connections due to metal fatigue in solder connections and is therefore only necessary for television sets more than two years old.

- Route the wire trees and EHT cable correctly and secure them with the mounted cable clamps.
- Check the insulation of the AC power cord for external damage.
- Check the strain relief of the AC power cord for proper function, to prevent the cord from touching the CRT, hot components, or heat sinks.
- Check the electrical DC resistance between the AC plug and the secondary side (only for sets that have an isolated power supply). Do this as follows:
  1. Unplug the AC power cord and connect a wire between the two pins of the AC plug.
  2. Turn on the main power switch (keep the AC power cord unplugged!).
  3. Measure the resistance value between the pins of the AC plug and the metal shielding of the tuner or the aerial connection of the set. The reading should be between 4.5 MΩ and 12 MΩ.
  4. Switch the TV OFF and remove the wire between the two pins of the AC plug.
- Check the cabinet for defects, to prevent the possibility of the customer touching any internal parts.

## 2.2 Maintenance Instructions

It is recommended to have a maintenance inspection carried out by qualified service personnel. The interval depends on the usage conditions:

- When the set is used under normal circumstances, for example in a living room, the recommended interval is three to five years.
- When the set is used in an environment with higher dust, grease or moisture levels, for example in a kitchen, the recommended interval is one year.
- The maintenance inspection includes the following actions:
  1. Perform the 'general repair instruction' noted above.
  2. Clean the power supply and deflection circuitry on the chassis.
  3. Clean the picture tube panel and the neck of the picture tube.

## 2.3 Warnings

- In order to prevent damage to ICs and transistors, avoid all high voltage flashovers. In order to prevent damage to the picture tube, use the method shown in Fig. 2-1, to discharge the picture tube. Use a high voltage probe and a multi-meter (position VDC). Discharge until the meter reading is 0 V (after approx. 30 s).

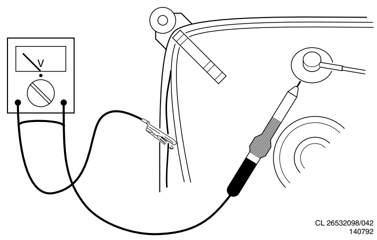



**Figure 2-1**

- All ICs and many other semiconductors are susceptible to electrostatic discharges (ESD). Careless handling during repair can reduce life drastically. When repairing, make sure that you are connected with the same potential as the mass of the set by a wristband with resistance. Keep components and tools also at this potential. Available ESD protection equipment:
  – Complete kit ESD3 (small tablemat, wristband, connection box, extension cable, and ground cable) 4822 310 10671.
  – Wristband tester 4822 344 13999.
- Together with the deflection unit and any multi-pole unit, flat square picture tubes form an integrated unit. The deflection and the multi-pole units are set optimally at the factory. Adjustment of this unit during repair is therefore not recommended.
- Be careful during measurements in the high voltage section and on the picture tube.
- Never replace modules or other components while the unit is switched ON.
- When you align the set, use plastic rather than metal tools. This will prevent any short circuits and the danger of a circuit becoming unstable.

## 2.4 Notes

- Measure the voltages and waveforms with regard to the chassis (= tuner) ground (⏚), or hot ground (⏚), depending on the area of circuitry being tested.
- The voltages and waveforms shown in the diagrams are indicative. Measure them in the Service Default Mode (see chapter 5) with a color bar signal and stereo sound (L: 3 kHz, R: 1 kHz unless stated otherwise) and picture carrier at 475.25 MHz (PAL) or 61.25 MHz (NTSC, channel 3).
- Where necessary, measure the waveforms and voltages with (⫪) and without (⫪̸) aerial signal. Measure the voltages in the power supply section both in normal operation (①) and in standby (⏻). These values are indicated by means of the appropriate symbols.
- The picture tube panel has printed spark gaps. Each spark gap is connected between an electrode of the picture tube and the Aquadag coating.
- The semiconductors indicated in the circuit diagram and in the parts lists are completely interchangeable per position with the semiconductors in the unit, irrespective of the type indication on these semiconductors.

# 3. Directions for use

Not Applicable

# 4. Mechanical Instructions

## 4.1 Rear Cover Removal

1. Remove all fixation screws of the rear cover.
2. Now pull the rear cover backward to remove it.

## 4.2 Service Position Main Panel

1. Disconnect the strain relief of the AC power cord.
2. Remove the main panel, by pushing the two center clips outward [1]. At the same time pull the panel away from the CRT [2].
3. Disconnect the degaussing coil by removing the cable from (red) connector 0201.
4. Move the panel somewhat to the left and flip it 90 degrees [3], with the components towards the CRT.

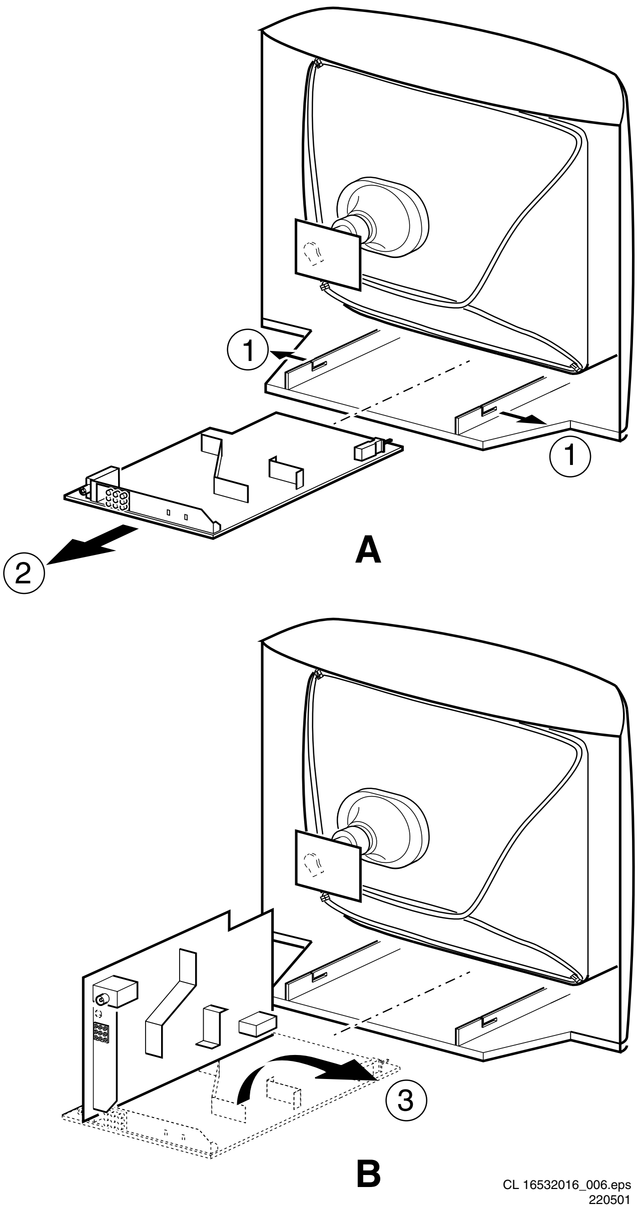



Figure 4-1

## 4.3 Side I/O Panel Removal

1. Remove the complete Side I/O assembly after unscrewing the 2 fixation screws.
2. Release the two fixation clamps and lift the board out of the bracket.

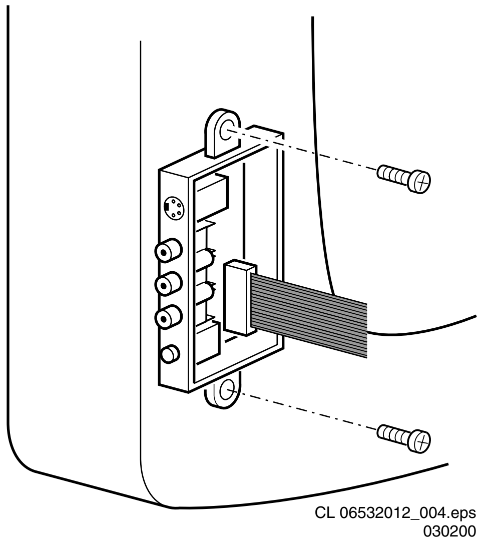



Figure 4-2

## 4.4 Rear Cover Mounting

Before you mount the rear cover, perform the following checks:

1. Check whether the AC power cord is mounted correctly in its guiding brackets.
2. Replace the strain relief of the AC power cord into the cabinet.
3. Check whether all cables are replaced in their original position.

# 5. Service Modes, Error Codes and Fault Finding

**Index:**

1. Test points.
2. Service Modes.
3. Problems and Solving Tips (related to CSM).
4. ComPair.
5. Error Codes.
6. The Blinking LED Procedure.
7. Protections.
8. Repair Tips.

## 5.1 Test Points

The chassis is equipped with test points printed on the circuit board assemblies. These test points refer to the functional blocks:

**Table 5-1 Test Point Overview**

| TEST POINT | CIRCUIT | DIAGRAM |
|---|---|---|
| A1-A2-A3... | AUDIO PROCESSING | A8,A9 / A11 |
| C1-C2-C3... | CONTROL | A7 |
| F1-F2-F3... | FRAME DRIVE & OUTPUT | A3 |
| I1-I2-I3... | TUNER & IF | A4 |
| L1-L2-L3... | LINE DRIVE & OUTPUT | A2 |
| P1-P2-P3... | POWER SUPPLY | A1 |
| S1-S2-S3... | SYNCHRONIZATION | A6 |
| V1-V2-V3... | VIDEO PROCESSING | A5,B1 |

The numbering is in a logical sequence for diagnostics. Always start diagnosing within a functional block in the sequence of the relevant test points for that block.

Perform measurements under the following conditions:

- Television set in Service Default Alignment Mode.
- Video input: Color bar signal.
- Audio input: 3 kHz left channel, 1 kHz right channel.

## 5.2 Service Modes

Service Default Alignment Mode (SDAM) offers several features for the service technician, while the Customer Service Mode (CSM) is used for communication between the servicer and the customer.
The L8 chassis also offers the option of using ComPair, a hardware interface between a computer and the TV chassis. It offers the abilities of structured troubleshooting, error code reading, and software version readout for all L8 chassis.
Minimum requirements for ComPair: a 486 processor, Windows 3.1 and a CD-ROM drive.
**Note:** ComPair products will become available as they are developed.

**Table 5-2 Service Modes**

| SW Cluster | Software name | UOC type | UOC Diversity | Special Features |
|---|---|---|---|---|
| 2US9 | L01UM9x.y | TDA9577 (SS) | 55K ROM Size | Mono (Magnavox) |
| 3US2 | L01UN2x.y | TDA9577 (SS) (LS) | 55K ROM Size | Stereo non-dBx (Magnavox) |
| 1US5 | L01US5x.y | TDA9588 (LS) | 64K ROM Size | Stereo non-dBx (Magnavox), Non PIP |
| 2US2 | L01UM2x.y | TDA9577 (LS) | 55K ROM Size | Mono(Philips) |
| 3US3 | L01UN3x.y | TDA9577 (SS) (LS) | 55K ROM Size | Stereo non-dBx (Philips), CVI |
| 1US4 | L01US4x.y | TDA9587 (SS), TDA9588 (LS) | 64K ROM Size | Stereo non-dBx (Philips), PIP |
| Abbreviations in Software name: U = USA (NAFTA), M = Mono, N = Stereo non-dBx and S = Stereo dBx. | | | | |

### 5.2.1 Service Default Alignment Mode (SDAM)

***Purpose***

- To create a predefined setting for measurements to be made.
- To override software protections.
- To start the blinking LED procedure.
- To change option settings.
- To display / clear the error code buffer.
- To perform alignments.

***Specifications***

- Tuning frequency: 61.25 MHz (channel 3)
- Color system: NTSC M
- All picture settings at 50% (brightness, color contrast, hue)
- Bass, treble and balance at 50%; volume at 25%.
- All service-unfriendly modes (if present) are disabled. The service unfriendly modes are:
  - (sleep) timer
  - child/parental lock
  - blue mute
  - hotel/hospitality mode
  - auto shutoff (when no 'IDENT' video signal is received for 15 minutes)
  - skipping of non-favorite presets / channels
  - auto-storage of personal presets
  - auto user menu timeout
- Run timer (maximum four digits displayed)
- Software version
- Option settings
- Error buffer reading and erasing
- Software alignments

***How to enter SDAM***

To enter SDAM, use one of the following methods:

- Press the following key sequence on the remote control transmitter:
  **0-6-2-5-9-6-MENU**
  Do not allow the display to time out between entries while keying the sequence.
- Short jumper wires 9631 and 9641 on the mono carrier (see Fig. 8-1) and apply AC power. Then press the power button (remove the short after start-up).
  **Caution:** Entering SDAM by shorting wires 9631 and 9641 will override the +8V-protection. Do this only for a short period. When doing this, the service-technician must know

exactly what he is doing, as it could damage the television set.

- Or via ComPair (with the ComPair 'Tools' RC7150 Service Remote, it should be possible to enter SDAM via the ComPair interface IR).

After entering SDAM, the following screen is visible, with S at the upper right side for recognition.

```
LLLL   AAABCD X.Y                          S
ERR  XX XX XX XX XX
OP   XXX XXX XXX XXX XXX XXX XXX

CLEAR                      CLEAR ?
OPTIONS                    >
AKB                        >
TUNER                      >
WHITE TONE                 >
GEOMETRY                   >
AUDIO                      >
```

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260402

**Figure 5-1 SDAM MENU**

***Explanation of SDAM Menu***

1. **LLLL**
   This represents the run timer. The run timer counts normal operation hours, but does not count standby hours. (maximum four digits displayed).
2. **AAABCD-X.Y**
   This is the software identification of the main microprocessor:
   - A = the project name (L01).
   - B = the region: E= Europe, A= Asia Pacific, U= NAFTA, L= LATAM.
   - C = the feature of software diversity: N = stereo non-dBx, S = stereo dBx, M = mono, D = DVD
   - D = the language cluster number:
   - X = the main software version number
   - Y = the sub software version number
   - SIndication of the service mode. S= SDAM= Service Default Alignment Mode.
3. **Error Buffer**
   Shows all errors detected since the last time the buffer was erased. Five errors possible.
4. **Option Bytes**
   Used to set the option bytes. See 'Options' in the Alignments section for a detailed description. Seven codes possible.
5. **Clear**
   Erases the contents of the error buffer. Select the CLEAR menu item and press the MENU RIGHT key. The contents of the error buffer are cleared.
6. **Options**
   Used to set the option bits. See 'Options' in the Alignments section for a detailed description.
7. **AKB**
   Used to disable (0) or enable (1) the 'black current loop' (AKB = Auto Kine Bias).
8. **Tuner**
   Used to align the tuner. See 'Tuner' in the Alignments section for a detailed description.
9. **White Tone**
   Used to align the white tone. See 'White Tone' in the Alignments section for a detailed description.
10. **Geometry**
    Used to align the geometry settings of the television. See 'Geometry' in the Alignments section for a detailed description.
11. **Audio**
    No audio alignment is necessary for this television set.

***How to navigate in SDAM***

- In SDAM, select menu items with the MENU UP/DOWN keys on the remote control transmitter. The selected item will be highlighted. When not all menu items fit on the screen, use the MENU UP/DOWN keys to display the next / previous menu items.
- With the MENU LEFT/RIGHT keys, it is possible to:
  - Activate the selected menu item.
  - Change the value of the selected menu item.
  - Activate the selected submenu.
- In SDAM, When you press the MENU button, the set will switch to the normal user menus (with the SDAM mode still active in the background). To return to the SDAM menu press the STATUS/EXIT button.
- When you press the MENU key in while in an SDAM submenu, you will return to the previous menu.

***How to store SDAM settings***

To store settings changed in SDAM leave the top level SDAM menu by using the POWER button on the remote control transmitter or the television set.

***How to exit SDAM***

Switch the set to STANDBY by pressing the POWER button on the remote control transmitter or the television set.
If you turn the television set off by removing the AC power (i.e., unplugging the television) without using the POWER button, the television set will remain in SDAM when AC power is re-applied, and the error buffer is not cleared.

### 5.2.2 Customer Service Mode (CSM)

***Purpose***

The Customer Service Mode shows error codes and information on the TV operation settings. The servicer can instruct the customer to enter CSM by telephone and read off the information displayed. This helps the servicer to diagnose problems and failures in the TV set before making a service call.
The CSM is a read-only mode; therefore, modifications are not possible in this mode.

***How to enter CSM***

To enter CSM, press the following key sequence on the remote control transmitter:
**1-2-3-6-5-4**
Do not allow the display to time out between entries while keying the sequence.
Upon entering the Customer Service Mode, the following screen will appear:

```
1                                         CSM
2
3  AAABCD X.Y
4  AKBS
5  TV SYSTEM/NOT TUNED
6  ERRORTBUFFER
```

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**Figure 5-2 CSM Menu**

***Explanation of CSM Menu***

1. Indication of the service mode CSM = Customer Service Mode
2. Reserved.
3. Software identification of the main microprocessor (see 'Service Default Alignment Mode' for an explanation)
4. Reserved item.
5. Indicates the type of TV system or whether or not the television is receiving an 'IDENT' signal on the selected source. If no 'IDENT' signal is detected, the display will read 'NOT TUNED'

6. Error code buffer. Displays the last five errors detected in the error code buffer.

***How to exit CSM***
To exit CSM, use one of the following methods:
- Press the MENU, STATUS/EXIT, or POWER button on the remote control transmitter.
- Press the POWER button on the television set.

## 5.3 Problems and Solving Tips Related to CSM

### 5.3.1 Picture Problems

**Note:** The problems described below are all related to the TV settings. The procedures used to change the value (or status) of the different settings are described.

***Picture too dark or too bright***
If:
- The picture improves when you have press the AUTO PICTURE button on the remote control transmitter, or
- The picture improves when you enter the Customer Service Mode

Then:
1. Press the AUTO PICTURE button on the remote control transmitter repeatedly (if necessary) to choose PERSONAL picture mode.
2. Press the MENU button on the remote control transmitter. This brings up the normal user menu.
3. In the normal user menu, use the MENU UP/DOWN keys to highlight the PICTURE sub menu (if necessary).
4. Press the MENU LEFT/RIGHT keys to enter the PICTURE sub menu.
5. Use the MENU UP/DOWN keys (if necessary) to select BRIGHTNESS.
6. Press the MENU LEFT/RIGHT keys to increase or decrease the BRIGHTNESS value.
7. Use the MENU UP/DOWN keys to select PICTURE.
8. Press the MENU LEFT/RIGHT keys to increase or decrease the PICTURE value.
9. Press the MENU button on the remote control transmitter twice to exit the user menu.
10. The new PERSONAL preference values are automatically stored.

***White line around picture elements and text***
If:
- The picture improves after you have pressed the 'Smart Picture' button on the remote control transmitter

Then:
1. Press the AUTO PICTURE button on the remote control transmitter repeatedly (if necessary) to choose PERSONAL picture mode.
2. Press the MENU button on the remote control transmitter. This brings up the normal user menu.
3. In the normal user menu, use the MENU UP/DOWN keys to highlight the PICTURE sub menu (if necessary).
4. Press the MENU LEFT/RIGHT keys to enter the PICTURE sub menu.
5. Use the MENU UP/DOWN keys to select SHARPNESS.
6. Press the MENU LEFT key to decrease the SHARPNESS value.
7. Press the MENU button on the remote control transmitter twice to exit the user menu.
8. The new PERSONAL preference value is automatically stored.

***Snowy picture***
Enter CSM, by pressing the following key sequence on the remote control transmitter**:**
**1-2-3-6-5-4**
Do not allow the display to time out between entries while keying the sequence.

Check CSM line 5. If this line reads 'Not Tuned,' check the following:
- Antenna not connected. Connect the antenna.
- No antenna signal or bad antenna signal. Connect a proper antenna signal.
- The tuner is faulty (in this case line 6, the Error Buffer line, will contain error number 10). Check the tuner and replace/repair the tuner if necessary.

***Black and white picture***
If:
- The picture improves after you have pressed the 'Smart Picture' button on the remote control transmitter

Then:
1. Press the AUTO PICTURE button on the remote control transmitter repeatedly (if necessary) to choose PERSONAL picture mode.
2. Press the MENU button on the remote control transmitter. This brings up the normal user menu.
3. In the normal user menu, use the MENU UP/DOWN keys to highlight the PICTURE sub menu (if necessary).
4. Press the MENU LEFT/RIGHT keys to enter the PICTURE sub menu.
5. Use the MENU UP/DOWN keys to select COLOR.
6. Press the MENU RIGHT key to increase the COLOR value.
7. Press the MENU button on the remote control transmitter twice to exit the user menu.
8. The new PERSONAL preference value is automatically stored.

***Menu text not sharp enough***
If:
- The picture improves after you have pressed the 'Smart Picture' button on the remote control transmitter.

Then:
1. Press the AUTO PICTURE button on the remote control transmitter repeatedly (if necessary) to choose PERSONAL picture mode.
2. Press the MENU button on the remote control transmitter. This brings up the normal user menu.
3. In the normal user menu, use the MENU UP/DOWN keys to highlight the PICTURE sub menu (if necessary).
4. Press the MENU LEFT/RIGHT keys to enter the PICTURE sub menu.
5. Use the MENU UP/DOWN keys to select PICTURE.
6. Press the MENU LEFT key to decrease the PICTURE value.
7. Press the MENU button on the remote control transmitter twice to exit the user menu.
8. The new PERSONAL preference value is automatically stored.

## 5.4 ComPair

### 5.4.1 Introduction

ComPair (Computer Aided Repair) is a service tool for Philips Consumer Electronics products. ComPair is a further development of the DST (special remote control transmitter for Service), which allows faster and more accurate diagnostics. ComPair has three big advantages:

- ComPair helps you quickly get an understanding on how to repair the chassis in a short time by guiding you systematically through the repair procedures.
- ComPair allows very detailed diagnostics (on $I^2C$ level) and is therefore capable of accurately indicating problem areas. You do not have to know anything about $I^2C$ commands yourself because ComPair takes care of this.
- ComPair speeds up the repair time since it can automatically communicate with the chassis (when the microprocessor is working) and all repair information is directly available. When ComPair is installed together with the Force electronic manual of the S8 chassis, schematics and CBAs are only a mouse-click away.

### 5.4.2 Specifications

ComPair consists of a Windows based faultfinding program and an interface box between PC and the product. The ComPair interface box is connected to the PC via a serial or RS232 cable.
In the case of the L01 chassis, the ComPair interface box and the TV communicate via a bi-directional service cable via the service connector (Connector 0217).
The ComPair faultfinding program is able to determine the problem of the television set. ComPair can gather diagnostic information in two ways:

- Automatic (by communication with the television):ComPair can automatically read the contents of the entire error buffer. Diagnosis is done on $I^2C$ level. ComPair can access the $I^2C$ bus of the television. ComPair can send and receive $I^2C$ commands to the microprocessor of the television. In this way, it is possible for ComPair to communicate (read and write) to devices on the $I^2C$ busses of the TV-set.
- Manually (by asking questions to the servicer):Automatic diagnosis is only possible if the microprocessor of the television is working correctly, and only to a certain extent. When this is not the case, ComPair will guide you through the faultfinding tree by asking you questions (for example; Does the screen gives a picture? Click on the correct answer: YES / NO) and showing you examples (for example; Measure test-point I7 and click on the correct oscillogram you see on the oscilloscope). You can answer by clicking on a link (for example, text or a waveform picture) that will bring you to the next step in the faultfinding process.

By a combination of automatic diagnostics and an interactive question and answer procedure, ComPair will enable you to find most problems in a fast and effective way.

Beside fault finding, ComPair provides some **additional features** like:

- Uploading or downloading of presets.
- Management of preset lists.
- If both ComPair and the Force electronic service manual are installed, all the schematics and CBAs of the television set are available by clicking on the appropriate hyperlink.Example:*Measure the DC-voltage on capacitor C2568 (Schematic/Panel) at the Monocarrier.*Click on the 'Panel'; hyperlink to automatically show the CBA with a highlighted capacitor C2568. Click on the 'Schematic' hyperlink to automatically show the electronic position of the highlighted capacitor.

### 5.4.3 How To Connect

1. First install the ComPair Browser software (see the Quick Reference Card for installation instructions).
2. Connect the RS232 interface cable between a free serial (COM) port of your PC and the PC connector (marked with 'PC') of the ComPair interface.
3. Connect the AC power adapter to the supply connector (marked 'POWER 9V DC') on the ComPair interface.
4. Switch the ComPair interface OFF.
5. Switch the television set OFF (and remove the AC power).
6. Connect the ComPair interface cable between the connector on the rear side of the ComPair interface (marked '$I^2C$') and the ComPair connector on the mono carrier (Connector 0217).
7. Plug the AC power adapter in the AC power outlet and switch on the ComPair interface. The green and red LEDs light up together. The red LED turns off after approximately 1 second, while the green LED remains lit.
8. Start the ComPair program and read the 'introduction' chapter.

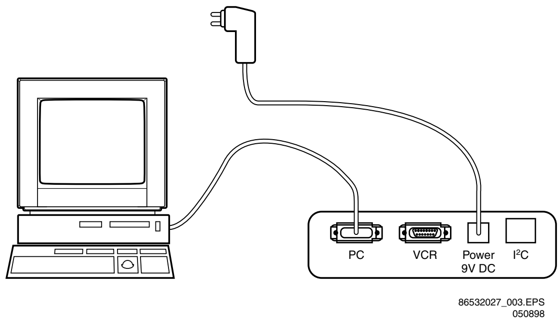



**Figure 5-3 ComPair connection**

### 5.4.4 How To Order

ComPair order codes:

- ComPair Interface Box 4822 727 21631
- CDR Interface board 3122 785 90200
- TV cable 3122 785 90004
- DVD cable 3122 785 90017
- BETA CALIBRATION DISK 7104 099 93132
- Extra Com Cable S83-940
- AC Adapter T405-ND

## 5.5 Error Buffer

The error code buffer contains all errors detected since the last time the buffer was erased. The buffer is written from left to right. When an error occurs that is not yet in the error code buffer, it is displayed at the left side and all other errors shift one position to the right.

### 5.5.1 How To Read The Error Buffer

You can read the error buffer in 3 ways:

- On screen via the SDAM (if you have a picture). Examples:
  - ERROR: 0 0 0 0 0 : No errors detected
  - ERROR: 6 0 0 0 0 : Error code 6 is the last and only detected error
  - ERROR: 9 6 0 0 0 : Error code 6 was detected first and error code 9 is the last detected (newest) error
- Via (when you have no picture). See 'The Blinking LED Procedure'
- Via ComPair.

### 5.5.2 How To Clear The Error Buffer

The error code buffer is cleared in the following cases:

- By using the CLEAR command in the SDAM menu:
  – To enter SDAM, Press the following key sequence on the remote control transmitter:
    **0-6-2-5-9-6-MENU**
    Do not allow the display to time out between entries while keying the sequence.
  – Make sure the menu item CLEAR is highlighted. Use the MENU UP/DOWN buttons, if necessary.
  – Press the MENU RIGHT button to clear the error buffer. The text on the right side of the ‘CLEAR’ line will change from ‘CLEAR?’ to ‘CLEARED’
- If the contents of the error buffer have not changed for 50 hours, the error buffer resets automatically.

**Note:** If SDAM is exited by disconnecting the AC power from the television set, the error buffer is not reset.

### 5.5.3 Error Codes

In case of non-intermittent faults, write down the errors present in the error buffer and clear the error buffer before you begin the repair.
This ensures that old error codes are no longer present.
If possible, check the entire contents of the error buffer. In some situations an error code is only the result of another error and not the actual cause of the problem (for example, a fault in the protection detection circuitry can also lead to a protection).

**Table 5-3 Error Code Table**

| ERROR | Device | Error description | Check item | Diagram |
|---|---|---|---|---|
| 0 | Not applicable | No Error | | |
| 1 | Not applicable | X-Ray Protection | 2465, 7460 | A2 |
| 2 | Not applicable | Horizontal Protection | 7460, 7461, 7462, 7463, 6467 | A2 |
| 3 | TDA8359/TDA9302 | Vertical Protection | 7861, VloAux +13v | A2, A3 |
| 4 | MSP34X5/TDA9853 | MAP I2C identification error | 7831, 7861 | A9 or A11 |
| 5 | TDA95XX | POR 3.3V / 8V Protection | 7200, 7560, 7480 | A1, A2. A5, A6, A7 |
| 6 | I2C bus | General I2C bus error | 7200, 3624, 3625 | A7 |
| 7 | Not applicable | - | - | - |
| 8 | Not applicable | E/W Protection (Large Screen) | 7400, 3405, 3406, 3400 | A2 |
| 9 | M24C08 | NVM I2C identification error | 7602, 3611, 3603, 3604 | A7 |
| 10 | Tuner | Tuner I2C identification error | 1000, 7482 | A2, A4 |
| 11 | TDA6107/8 | Black current loop protection | 7330, RGB amps, CRT | B1, B2 |
| 12 | M65669 | MAP I2C identification error | 7803 | P |

**Note:** Error 7 is not applicable.

For a detailed description see Chapter 9 paragraphs 3.4 and 4.5.

## 5.6 The Blinking LED Procedure

Using this procedure, you can make the contents of the error buffer visible via the front LED. This is especially useful when there is no picture.

When the SDAM is entered, the LED will blink the contents of the error-buffer:
- 1-12 short blinks (indicates error number 1-12)
- when all the error-codes are displayed, the sequence finishes with an ‘ON’ LED blink of 3 seconds
- the sequence starts again

Example of error buffer: 12 9 6 0 0
After entering SDAM, the following occurs:
- 12 short blinks followed by a pause of 3 seconds
- 9 short blinks followed by a pause of 3 seconds
- 6 short blinks followed by a pause of 3 seconds
- 1 long ‘ON’ blink of 3 seconds to finish the sequence
- the sequence starts again.

## 5.7 Protections

If a fault situation is detected, an error code will be generated; and, if necessary, the television set will go in to protection mode. Blinking of the red LED at a frequency of 3 Hz indicates the protection mode. In some error cases, the microprocessor does not put the set in protection mode. The error codes of the error buffer and the blinking LED procedure can be read via the Service Default Alignment Menu (SDAM), or via ComPair.
To get a quick diagnosis the chassis has two service modes implemented:
- The Customer Service Mode (CSM).
- The Service Default Alignment Mode (SDAM).

## 5.8 Repair Tips

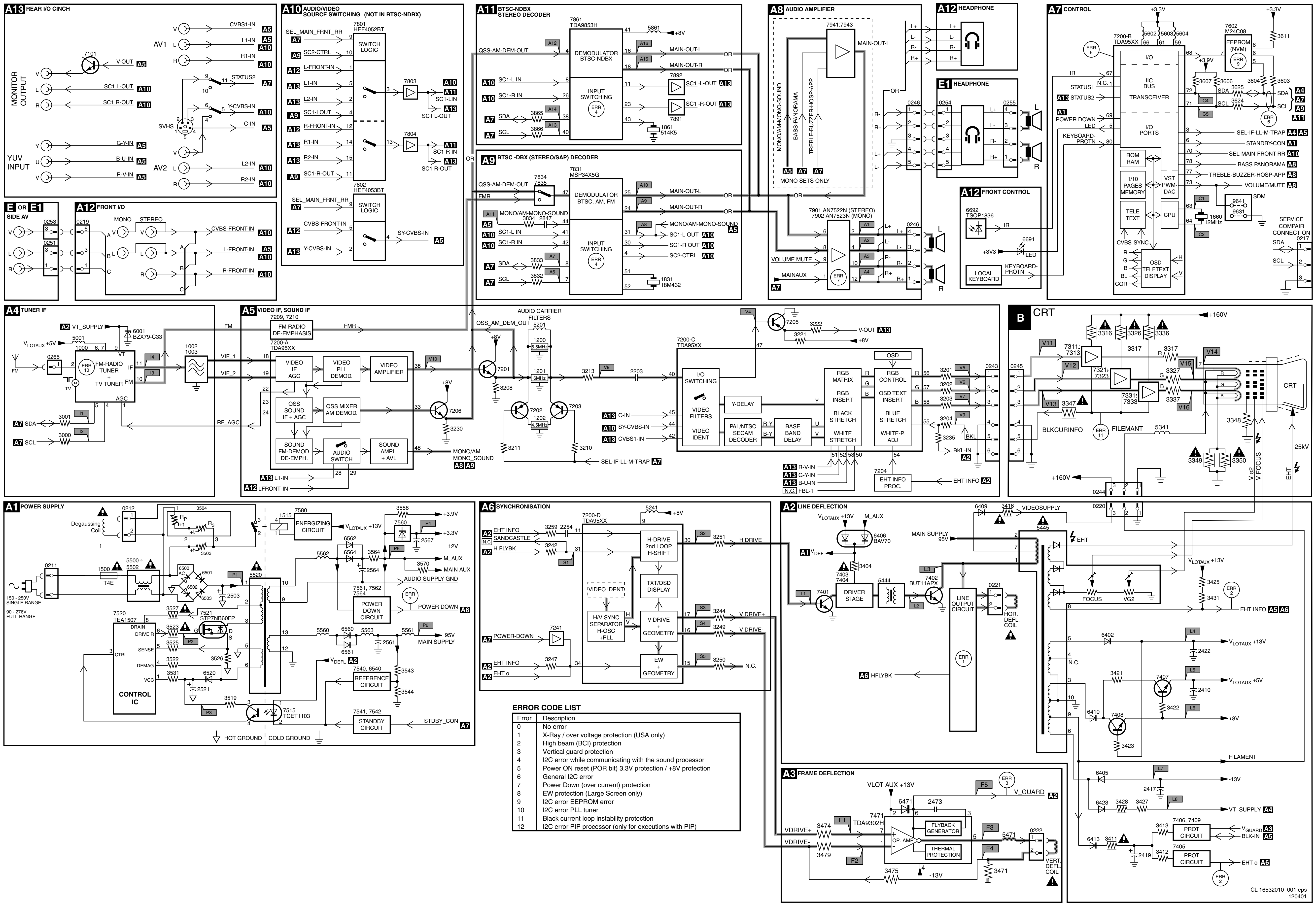
Below some failure symptoms are given, followed by a repair tip.

- **Set is dead and makes hiccuping sound**
  'Main Power Supply' is available. Hiccupping stops when L5561 is de-soldered, meaning that problem is in the 'Main Power Supply' line. No output voltages at LOT, no horizontal deflection. Reason: line transistor 7460 is defective.
- **Set is dead, and makes no sound**
  Check power supply IC 7520. Result: voltage at pins 1, 3, 4, 5 and 6 are about 180 V and pin 8 is 0 V. The reason why the voltage on these pins is so high is because the output driver (pin 6) has an open load. That is why MOSFET 7521 is not able to switch. Reason: feedback resistor 3523 is defective.
  **Caution:** Be careful measuring the gate of 7521; circuitry is very high ohmic and can easily be damaged!
- **Set is in hiccup mode and shuts down after 8 seconds**
  Blinking LED (set is in SDAM mode) indicates error 5. As it is unlikely that µP 'POR' and '+8V protection' happen at the same time, measure the '+8V' supply. If this voltage is missing, check transistor 7480.
- **Set is in non-stop hiccup mode**
  Set is in over-current mode; check the secondary sensing (opto coupler 7515) and the 'Main Power Supply' voltage. Signal 'Stdby_con' must be logic low under normal operation conditions and goes to high (3.3 V) under standby and fault conditions.
- **Set turns on, but without picture and sound**
  The screen shows snow, but OSD and other menus are okay. Blinking LED procedure indicates error 11, so problem is expected in the tuner (part reference number 1000). Check presence of supply voltages. 'Vlotaux+5V' voltages at pin 5 and 7 are okay; 'VT_supply' at pin 9 is missing. Conclusion: resistor 3460 is defective.
- **Set turns on, but with a half screen at the bottom. Sound is okay**
  Blinking LED (set is in SDAM mode) indicates error 3. Check 'Vlotaux+11V' and '+50V'. If they are okay, problem is expected in the vertical amplifier IC 7471. Use an oscilloscope to measure the waveform on pin 17 of the UOC. Also measure the waveform at pin 1 of IC 7471. If the signal there is missing, a defective resistor R3244 caused the problem

## *Personal Notes:*

# 6. Block Diagram, Testpoints, I$^2$C and Supply Voltage Overview

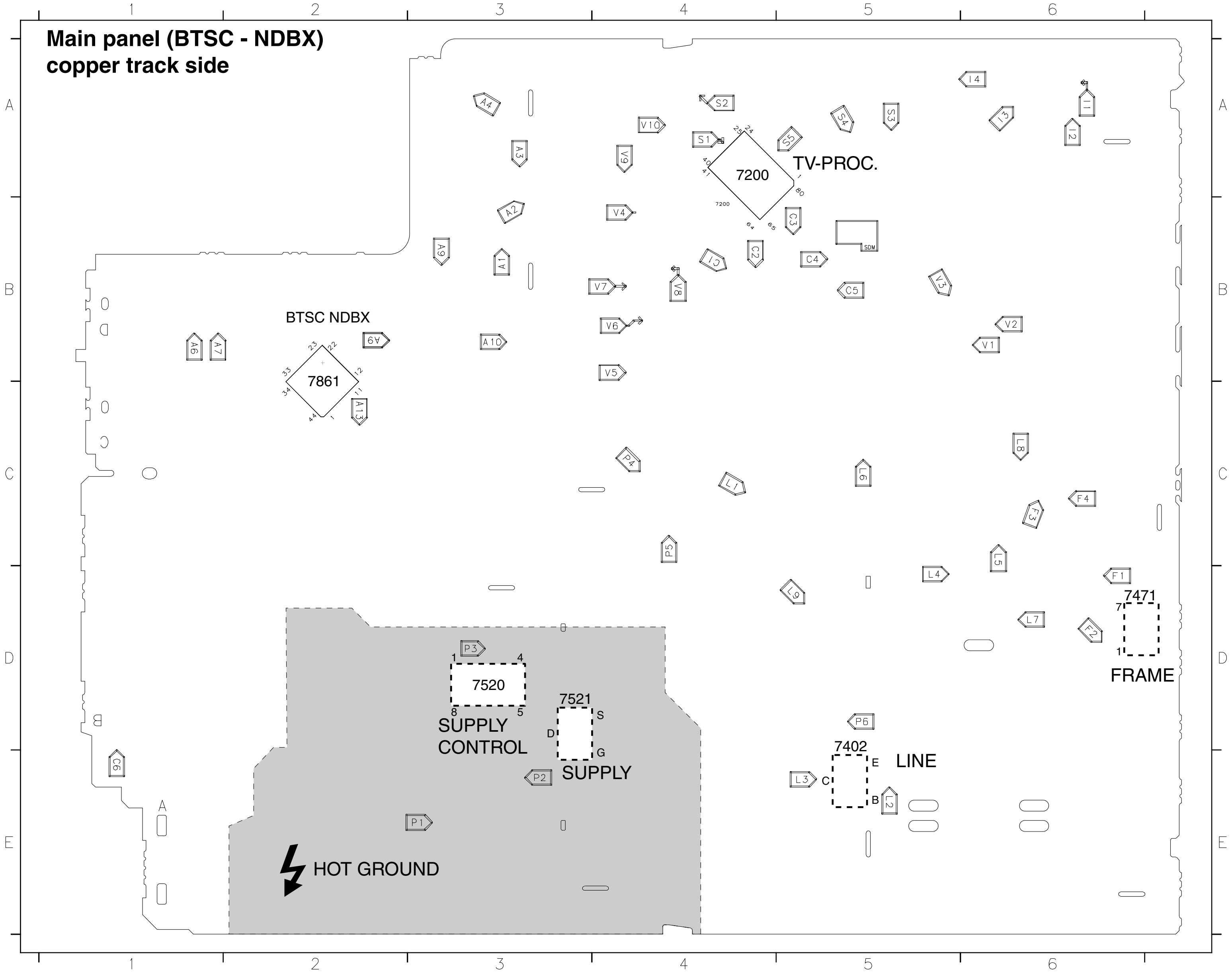
## Block Diagram



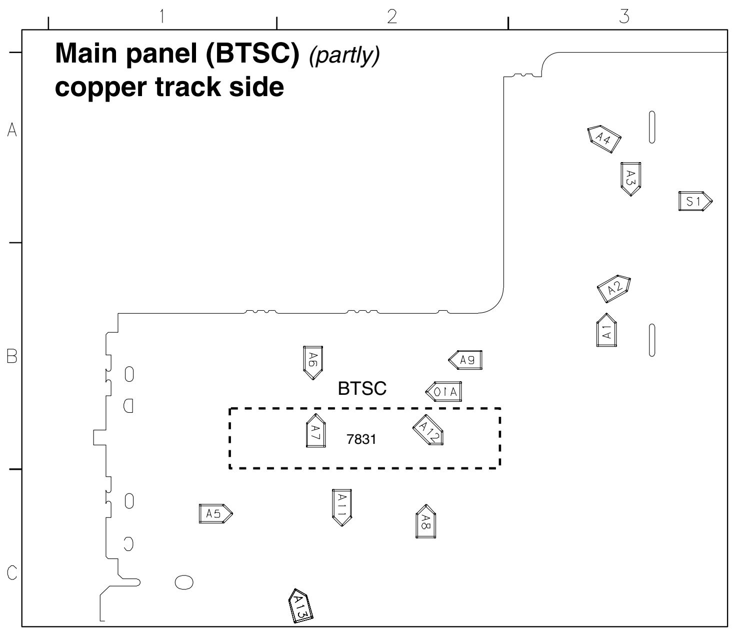

**ERROR CODE LIST**

| Error | Description |
|---|---|
| 0 | No error |
| 1 | X-Ray / over voltage protection (USA only) |
| 2 | High beam (BCI) protection |
| 3 | Vertical guard protection |
| 4 | I2C error while communicating with the sound processor |
| 5 | Power ON reset (POR bit) 3.3V protection / +8V protection |
| 6 | General I2C error |
| 7 | Power Down (over current) protection |
| 8 | EW protection (Large Screen only) |
| 9 | I2C error EEPROM error |
| 10 | I2C error PLL tuner |
| 11 | Black current loop instability protection |
| 12 | I2C error PIP processor (only for executions with PIP) |

## Testpoint Overview

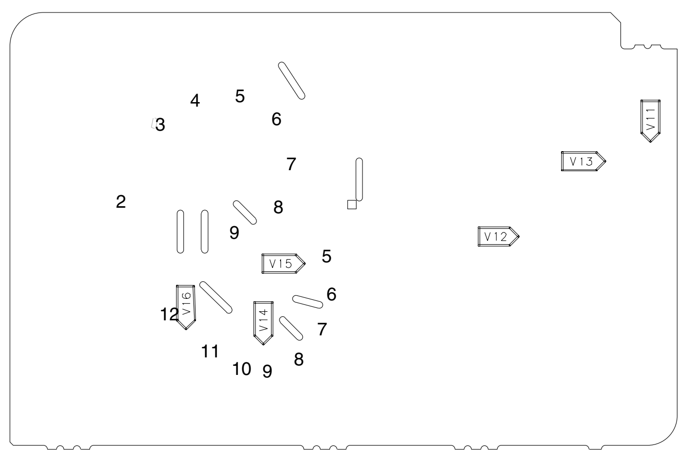



| | |
|---|---|
| A1 | B3 |
| A2 | B3 |
| A3 | A3 |
| A4 | A3 |
| A5 | C1 |
| A6 | B1 |
| A7 | B1 |
| A8 | C2 |
| A9 | B2 |
| A10 | B3 |
| A11 | C2 |
| A12 | B2 |
| A13 | C3 |
| C1 | B4 |
| C2 | B4 |
| C3 | B5 |
| C4 | B5 |
| C5 | B5 |
| C6 | E1 |
| F1 | D6 |
| F2 | D6 |
| F3 | C6 |
| F4 | C6 |
| I1 | A6 |
| I2 | A6 |
| I3 | A6 |
| I4 | A6 |
| L1 | C4 |
| L2 | E5 |
| L3 | E5 |
| L4 | D5 |
| L6 | C5 |
| L8 | C6 |
| L9 | D5 |
| P1 | E3 |
| P2 | E3 |
| P3 | D3 |
| P4 | C4 |
| P5 | C4 |
| P6 | D5 |
| S1 | A4 |
| S2 | A4 |
| S3 | A5 |
| S4 | A5 |
| S5 | A4 |
| V1 | B6 |
| V2 | B6 |
| V3 | B5 |
| V4 | B4 |
| V5 | B4 |
| V6 | B4 |
| V7 | B4 |
| V8 | B4 |
| V9 | A4 |
| V10 | A4 |



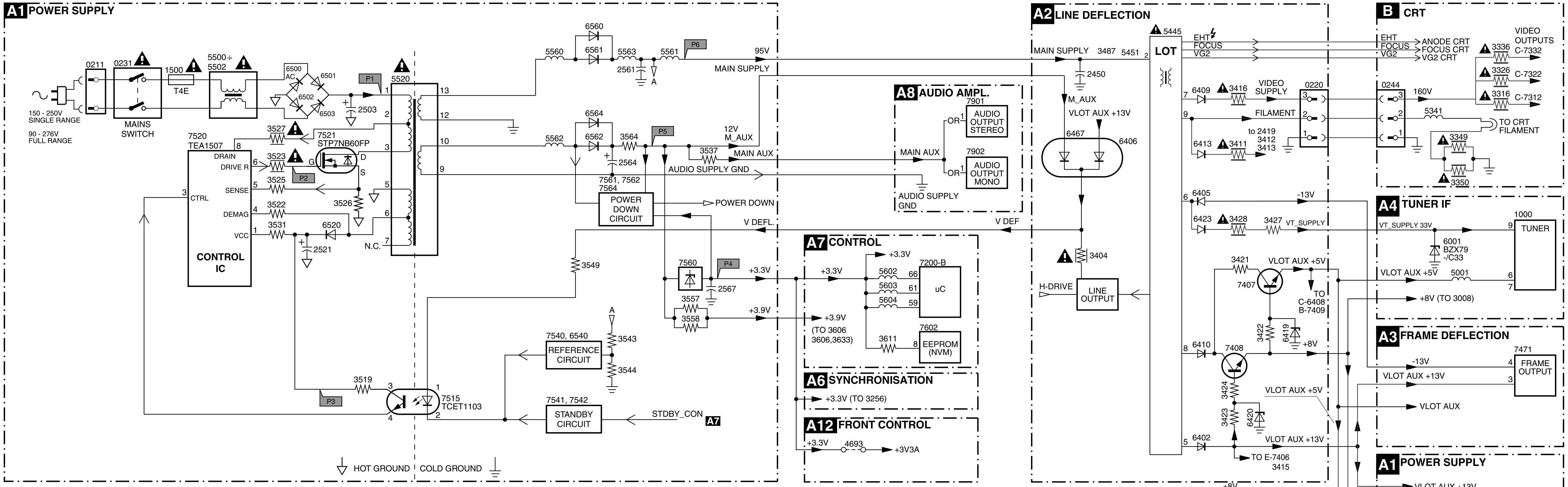

| | |
|---|---|
| A1 | B3 |
| A2 | B3 |
| A3 | A3 |
| A4 | A3 |
| A5 | C1 |
| A6 | B1 |
| A7 | B1 |
| A8 | C2 |
| A9 | B2 |
| A10 | B3 |
| A11 | C2 |
| A12 | B2 |
| A13 | C3 |

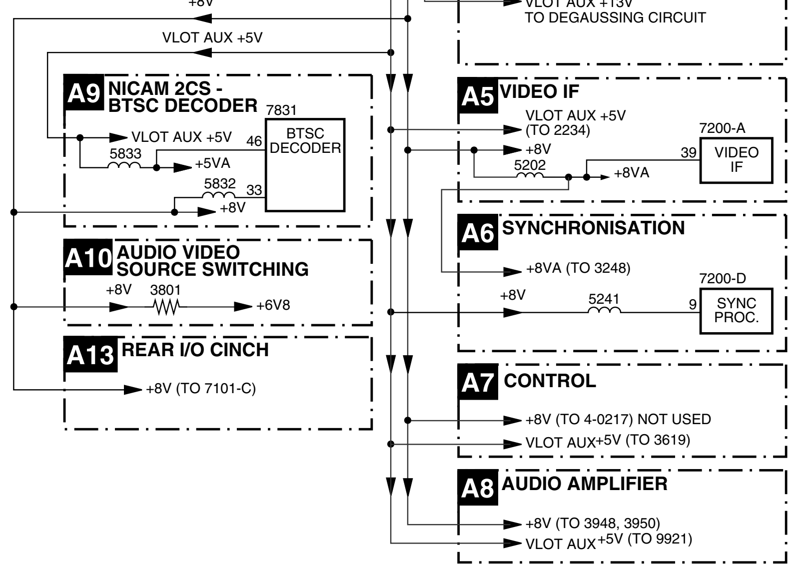
### CRT panel copper track side



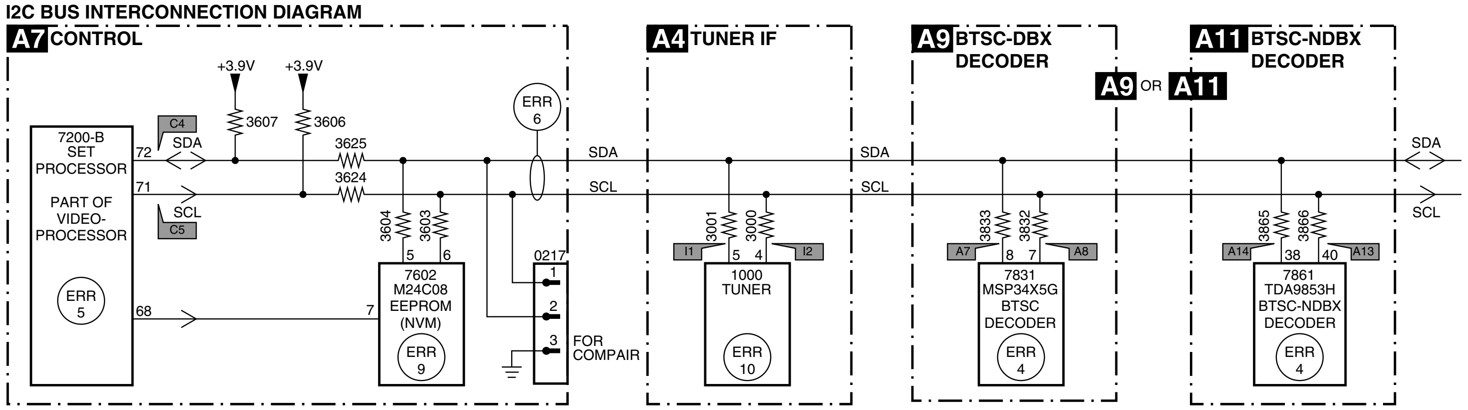
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## I$^2$C and Supply Voltage Diagram



I2C BUS INTERCONNECTION DIAGRAM




ERROR CODE LIST

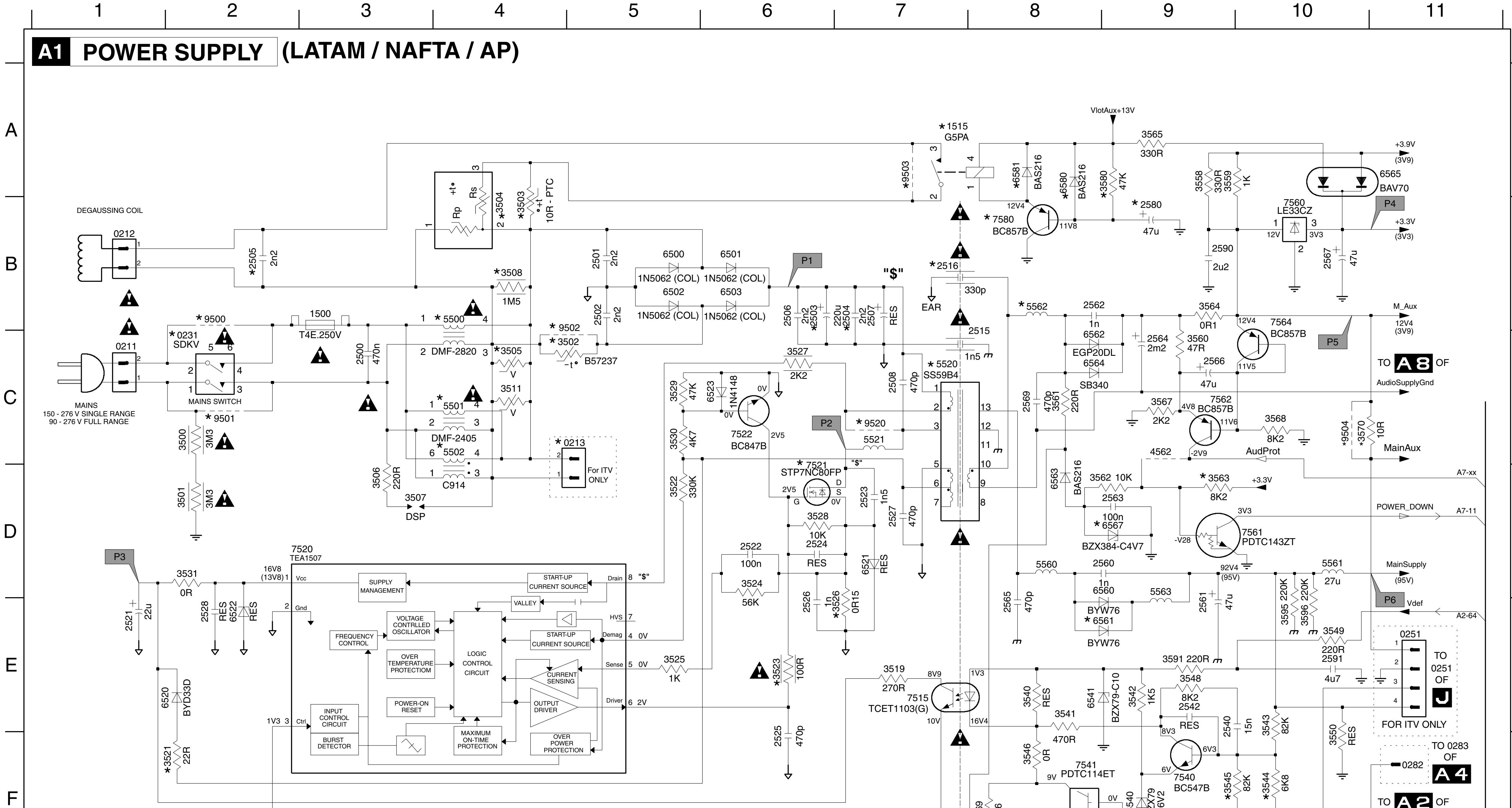
| Error | Description |
|---|---|
| 0 | No error |
| 1 | X-Ray / over voltage protection |
| 2 | High beam (BCI) protection |
| 3 | Vertical guard protection |
| 4 | I2C error while communicating with the sound processor |
| 5 | Power ON reset (POR bit) 3.3V protection / +8V protection |
| 6 | General I2C error |
| 7 | Power down (over current) protection |
| 8 | EW protection (Large Screen only) |
| 9 | I2C error EEPROM error |
| 10 | I2C error PLL tuner |
| 11 | Black current loop instability protection |
| 12 | I2C error PIP processor (only for executions with PIP) |

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# 7. Schematics and PWB's

## Mono Carrier: Power Supply

### A1 POWER SUPPLY (LATAM / NAFTA / AP)



| ITEM NO | SNDAMP-1X4W-MN-15RF-AP | SNDAMP-2X3W-ST-NA |
|---|---|---|
| 2566 | 47uF/25V | 47uF/25V |
| 3560 | 47R | 47R |
| 3564 | 0R1 | 0R1 |
| 3567 | 2K2 | 2K2 |
| 3568 | 8K2 | 8K2 |
| 3570 | - | - |
| 7562 | BC857B | BC857B |
| 7564 | BC857B | BC857B |

"S" FOR MAINS 120V AC 170V (177V)
220V AC 309V (317V)

..V.. Normal Operation
(..V..) Standy Mode

HOT GROUND
COLD GROUND

| REGION | NA | | | LA |
|---|---|---|---|---|
| MAINS RANGE | LR | | | FR |
| AUDIO OUTPUT | 2X5W | | | 2X5W |
| SET | 13V | S1W-19V | S3W-19V | 201 |
| 1515 | - | LKS1AF | LKS1AF | - |
| 2503 | 220V 220U | 200V 220U | 200V 220U | 400V 220U |
| 2505 | 1KV 2N2 | - | - | 1KV 2N2 |
| 2516 | - | - | - | - |
| 2580 | - | 25V 47U | 25V47U | - |
| 3503 | PTC 120V 10R | PTC 120V 10R | PTC 120V 10R | - |
| 3504 | - | - | - | PTC 200V 100R |
| 3505 | - | - | - | - |
| 3508 | - | 1M5 | 1M5 | - |
| 3521 | 4R7 | 4R7 | 22R | 4R7 |
| 3523 | RST FUSE 100R | RST FUSE 100R | RST FUSE 100R | RST FUSE 47R |
| 3544 | 6K8 | 6K8 | 6K8 | 6K8 |
| 3545 | 82K | 82K | 82K | 82K |
| 3552 | 4K7 | 4K7 | 4K7 | 4K7 |
| 3561 | 100R | 100R | 100R | 220R |
| 3563 | 4K7 | 4K7 | 4K7 | 8K2 |
| 3580 | - | 47K | 47K | - |

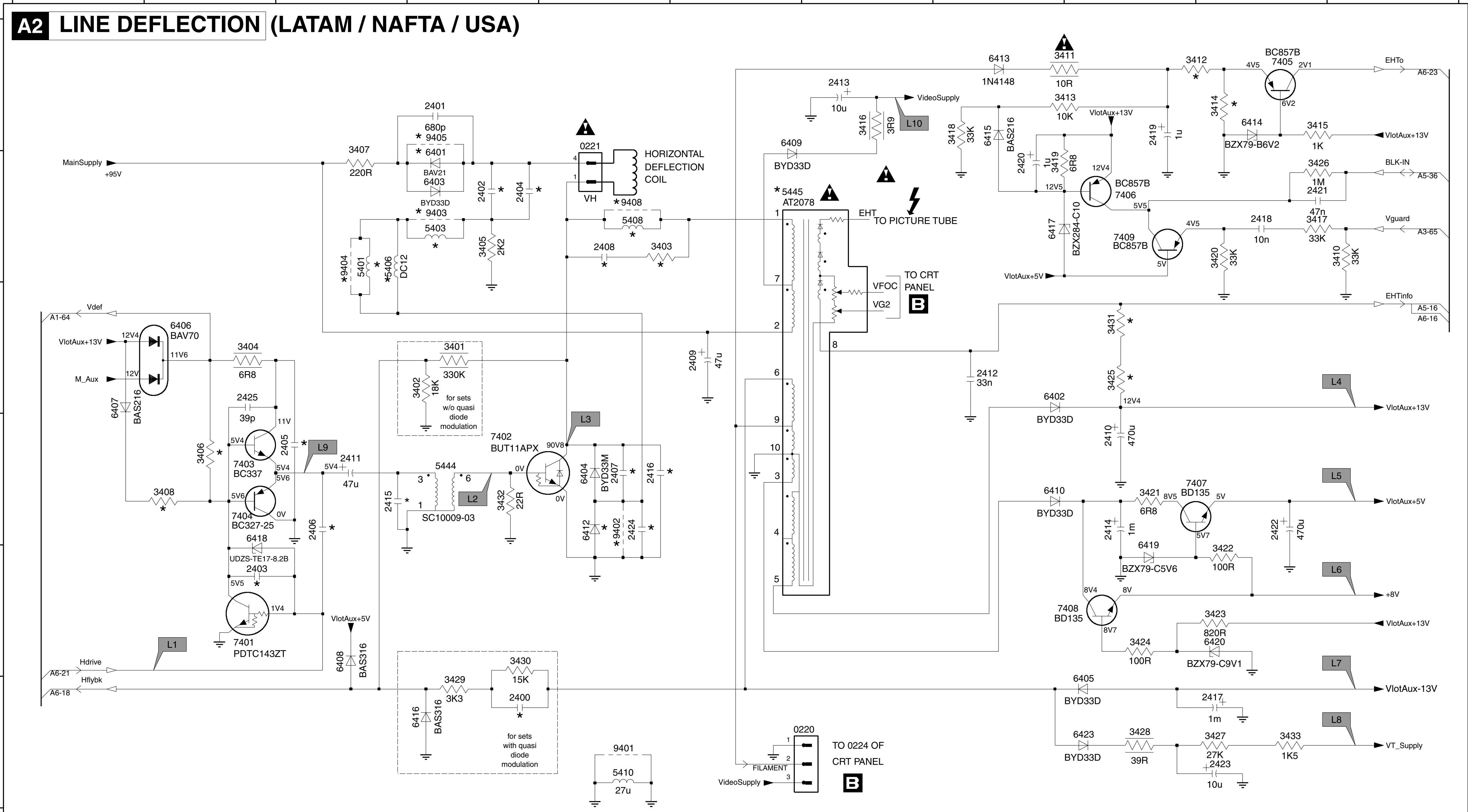
| REGION | NA | | | LA |
|---|---|---|---|---|
| MAINS RANGE | LR | | | FR |
| AUDIO OUTPUT | 2X5W | | | 2X5W |
| SET | 13V | S1W-19V | S3W-19V | 201 |
| 3591 | SMD JUMPER | SMD JUMPER | SMD JUMPER | SMD JUMPER |
| 3595 | 180K | 180K | 180K | 180K |
| 3596 | 180K | 180K | 180K | 180K |
| 4411 | SMD JUMPER | SMD JUMPER | SMD JUMPER | SMD JUMPER |
| 4562 | SMD JUMPER | SMD JUMPER | SMD JUMPER | SMD JUMPER |
| 5500 | - | - | - | FIL MAINS 20MH |
| 5501 | - | - | - | - |
| 5502 | FL MAINS 5MH | FIL MAINS 5MH | FIL MAINS 5MH | - |
| 5520 | SS28011-04B | SS28011-04B | SS28011-04B | SS359B4-09 |
| 5562 | BEAD 100MHZ 50R | BEAD 100MHZ 50R | BEAD 100MHZ 50R | BEAD 100MHZ 80R |
| 6561 | - | BYW76-RAS15/10 | BYW76-RAS15/10 | BYW76-RAS15/10 |
| 6567 | - | - | - | BZX384-C4V7 |
| 6570 | BZX384-C6V8 | BZX384-C6V8 | BZX384-C6V8 | BZX384-C6V2 |
| 6580 | - | BAS816 | BAS816 | - |
| 7515 | TCET1103 | TCET1103 | TCET1103 | TCET1104 |
| 7521 | STP5NC50FP | STP5NC50FP | STP5NC50FP | STP7NC80ZFP |
| 7580 | - | BC857B | BC857B | - |

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0211 C1
0212 B1
0213 C5
0231 C2
0251 E11
0282 F11
1500 B3
1515 A7
2500 C3
2501 B5
2502 B5
2503 B6
2504 B7
2505 B2
2506 B6
2507 B7
2508 C7
2515 C8
2516 B7
2520 F2
2521 E1
2522 D6
2523 D7
2524 D6
2525 F6
2526 E6
2527 D7
2528 E2
2540 E9
2541 F8
2542 E9
2559 G10
2560 D9
2561 E9
2562 B8
2563 D9
2564 C9
2565 E8
2566 C9
2567 B10
2568 G8
2569 C8
2580 B9
2590 B9
2591 E10
3500 C2
3501 D2
3502 C5
3503 B4
3504 B4
3505 C4
3506 D3
3507 D3
3508 B4
3511 C4
3519 E7
3520 F2
3521 F2
3522 D5
3523 E6
3524 D6
3525 E5
3526 E7
3527 C6
3528 D6
3529 C5
3530 C5
3531 D2
3540 E8
3541 E8
3542 E9
3543 E10
3544 F10
3545 F9
3546 F8
3547 F9
3548 E9
3549 E10
3550 F10
3552 F8
3558 A9
3559 A9
3560 C9
3561 C8
3562 D8
3563 D9
3564 B9
3565 A9
3566 G8
3567 C9
3568 C10
3569 F8
3570 C10
3580 A9
3591 E9
3595 E10
3596 E10
4562 C9
5500 B4
5501 C4
5502 C4
5505 G9
5520 C7
5521 C7
5560 D8
5561 D10
5562 B8
5563 D9
6500 B5
6501 B6
6502 B5
6503 B6
6520 E1
6521 D7
6522 E2
6523 C6
6540 F9
6541 E8
6560 D9
6561 E9
6562 C8
6563 D8
6564 C8
6565 A11
6566 F9
6567 D9
6569 G8
6570 G8
6580 A8
6581 A8
7515 E7
7520 D2
7521 D6
7522 C6
7540 F9
7541 F8
7542 F8
7560 B10
7561 D10
7562 C9
7564 B10
7580 B8
9500 B2
9501 C2
9502 C5
9503 A7
9504 C10
9520 C7

## Mono Carrier: Line Deflection

# A2 LINE DEFLECTION (LATAM / NAFTA / USA)




| REGION | NA | | | LA |
|---|---|---|---|---|
| MAINS RANGE | LR | | | FR |
| AUDIO OUTPUT | 2X5W | | | 2X5W |
| SET | 13V | S1W-19V | S3W-19V | 201 |
| 4411 | SMD JUMPER | SMD JUMPER | SMD JUMPER | SMD JUMPER |

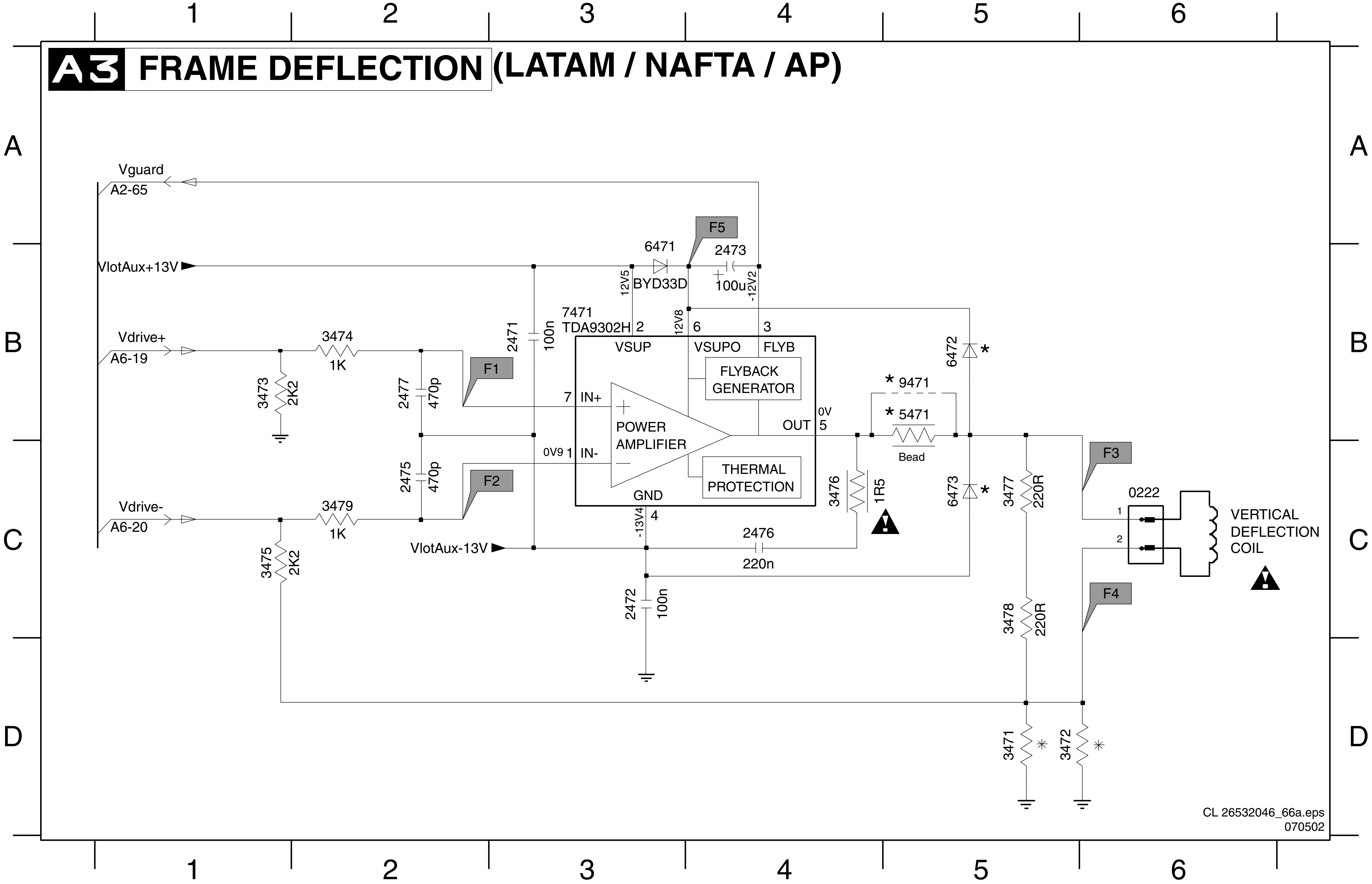
| REGION | NA | | | | | NAFTA |
|---|---|---|---|---|---|---|
| TUBE | PHCO | | SMGK | OECO | PH.HF | PHCO |
| SET | 13V | 19V | 18V | 19V | 20V | 20I |
| 2402 | 250V 560N | 250V 680N | 250V 820N | 250V 820N | - | 250V 680N |
| 2404 | - | - | - | - | 250V 560N | - |
| 2405 | 50V 1N | 50V 1N | 50V 1N | 50V 1N | 50V 1N | - |
| 2407 | 1K6V 8N2 | 1K6V 10N | 1K6V 10N | 1K6V 10N | 1K6V 13N | 1K6V 11N |
| 2408 | 50V 22N | 50V 22N | 50V 22N | 50V 22N | - | 50V 22N |
| 2412 | 470R | 470R | 470R | 470R | 470R | - |
| 2416 | 2KV 470P | 2KV 820P | - | 2KV 820P | 2KV 1N2 | - |
| 3403 | 3W 22R | 3W 22R | 3W 22R | 3W 22R | - | 3W 22R |
| 3405 | - | - | - | - | 2K2 | - |
| 3407 | 3W 220R | 3W 220R | 3W 220R | 3W 220R | 3W 220R | 3W 220R |
| 3412 | 3K3 | 3K3 | 3K3 | 3K3 | 3K3 | 39K |
| 3414 | 1K5 | 1K5 | 1K5 | 1K5 | 1K5 | 12K |
| 3425 | 15K | 15K | 12K | 15K | 10K | 15K |

| REGION | NA | | | | | NAFTA |
|---|---|---|---|---|---|---|
| TUBE | PHCO | | SMGK | OECO | PH.HF | PHCO |
| SET | 13V | 19V | 18V | 19V | 20V | 20I |
| 3426 | SMD JUMPER | SMD JUMPER | SMD JUMPER | SMD JUMPER | 1M | SMD JUMPER |
| 3431 | 3K3 | SMD JUMPER | 2K2 | SMD JUMPER | 3K3 | SMD JUMPER |
| 3471 | 6R8 | 3R9 | 3R9 | 4R7 | 3R3 | 3R3 |
| 3472 | 3R9 | 3R9 | 3R9 | 4R7 | 3R9 | 4R7 |
| 5403 | - | - | - | - | 56UH | - |
| 5406 | - | - | - | - | 38UH C912-01(91033) | - |
| 5408 | SPT0508 27UH | SPT0508 27UH | SPT0508 27UH | SPT0508 27UH | - | SPT0508 27UH |
| 5410 | SPT0508 27UH | SPT0508 27UH | SPT0508 27UH | SPT0508 27UH | SPT0508 27UH | SPT0508 27UH |
| 5445 | MSLOT4 (21541) | MSLOT4(21541) | MSLOT4(21541) | MSLOT4(21541) | JF0501-19816 | SLOT (20662) |
| 6401 | BAV21 | BAV21 | BAV21 | BAV21 | BAV21 | BAV21 |
| 6403 | - | - | - | - - | - | - |
| 6417 | - | - | - | - | BZX384-C10 | - |
| 9403 | JUMPER | JUMPER | JUMPER | JUMPER | - | JUMPER |
| 9404 | JUMPER | JUMPER | JUMPER | JUMPER | - | JUMPER |
| 9408 | - | - | - | - | JUMPER | - |

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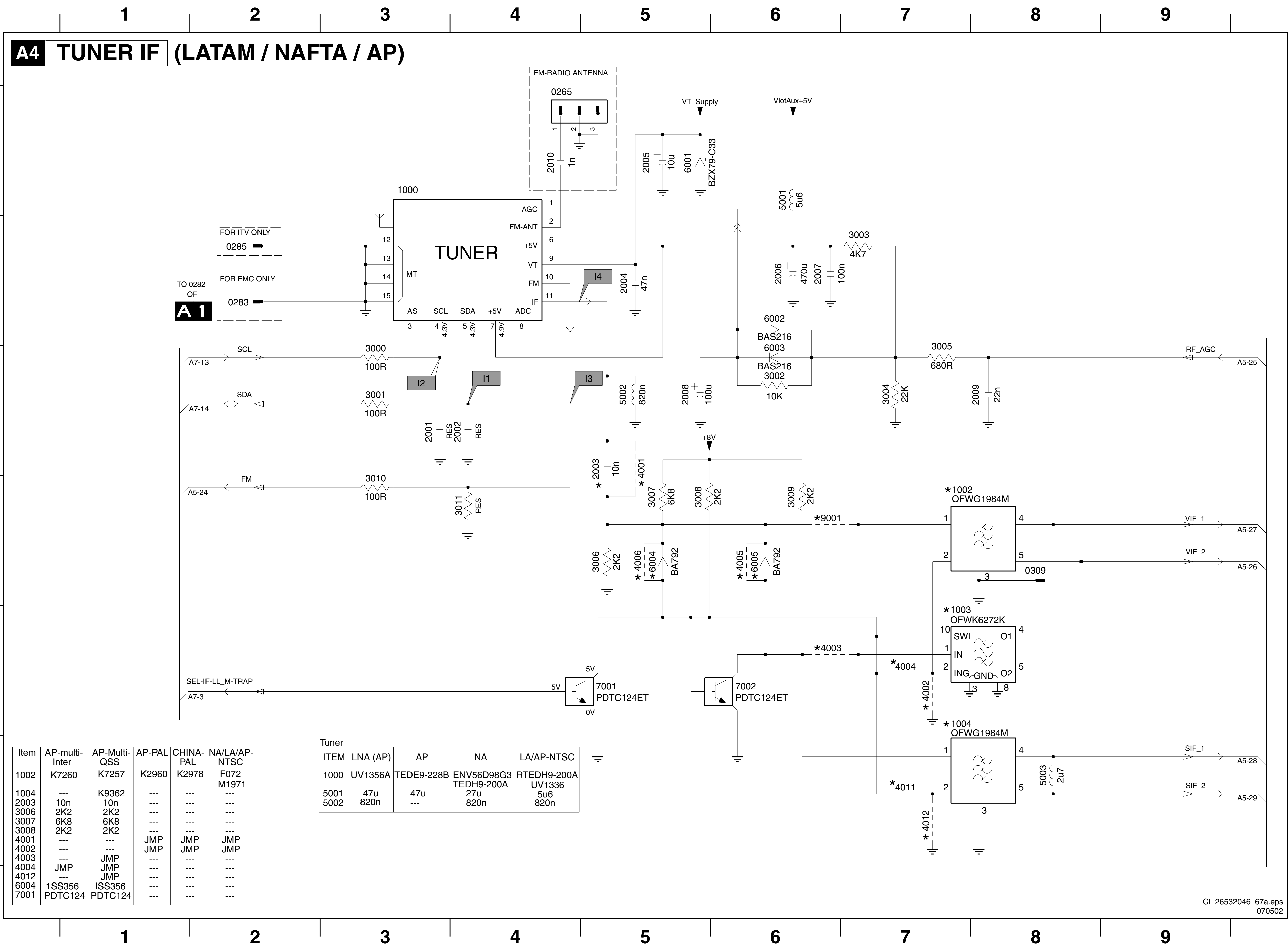
0220 F6
0221 A5
2400 F4
2401 A4
2402 B4
2403 E2
2404 B4
2405 D3
2406 D3
2407 D5
2408 B5
2409 C6
2410 D9
2411 D3
2412 C8
2413 A7
2414 D9
2415 D3
2416 D5
2417 F10
2418 B10
2419 A9
2420 B8
2421 B10
2422 D10
2423 F10
2424 D5
2425 C2
3401 C4
3402 C4
3403 B5
3404 C2
3405 B4
3406 D2
3407 B3
3408 D2
3410 B11
3411 A9
3412 A10
3413 A9
3414 A10
3415 A10
3416 A7
3417 B10
3418 A8
3419 B8
3420 B10
3421 D9
3422 E10
3423 E10
3424 E9
3425 C9
3426 B10
3427 F10
3428 F9
3429 F4
3430 E4
3431 C9
3432 D4
3433 F10
5401 B3
5403 B4
5406 B3
5408 B5
5410 F5
5444 D4
5445 B6
6401 B4
6402 C8
6403 B4
6404 D5
6405 F9
6406 C2
6407 C1
6408 E3
6409 A6
6410 D8
6412 D5
6413 A8
6414 A10
6415 A8
6416 F4
6417 B8
6418 D2
6419 E9
6420 E10
6423 F9
7401 E2
7402 D4
7403 D2
7404 D2
7405 A10
7406 B9
7407 D10
7408 E9
7409 B9
9401 F5
9402 D5
9403 B4
9404 B3
9405 A4
9408 B5

**Mono Carrier: Frame Deflection**




0222 C6
2471 B3
2472 C3
2473 B4
2475 C2
2476 C4
2477 B2
3471 D5
3472 D5
3473 B1
3474 B2
3475 C1
3476 C4
3477 C5
3478 C5
3479 C2
5471 B5
6471 A3
6472 B5
6473 C5
7471 B3
9471 B5

## Mono Carrier: Tuner IF



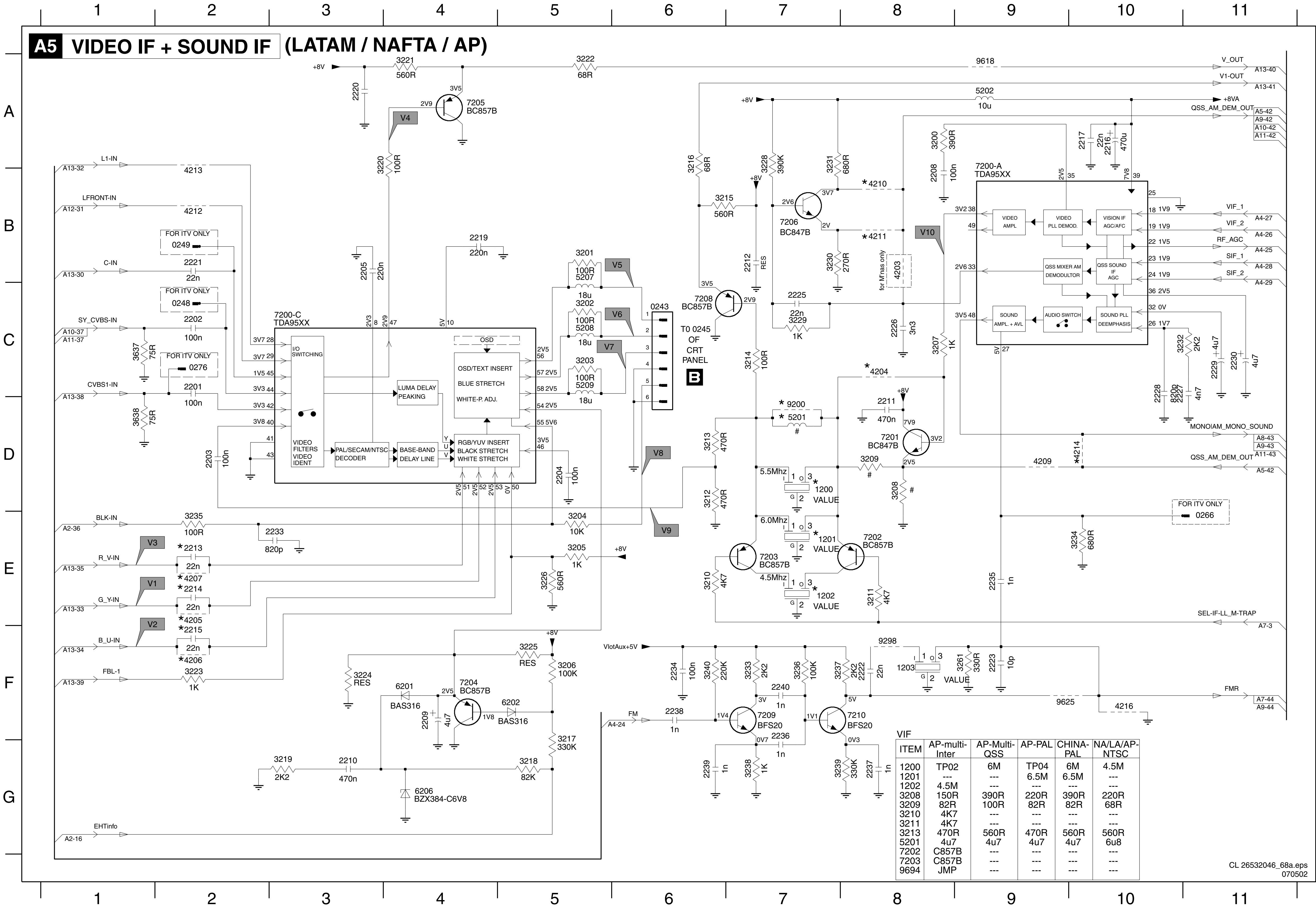

| Item | AP-multi-Inter | AP-Multi-QSS | AP-PAL | CHINA-PAL | NA/LA/AP-NTSC |
|---|---|---|---|---|---|
| 1002 | K7260 | K7257 | K2960 | K2978 | F072 M1971 |
| 1004 | --- | K9362 | --- | --- | --- |
| 2003 | 10n | 10n | --- | --- | --- |
| 3006 | 2K2 | 2K2 | --- | --- | --- |
| 3007 | 6K8 | 6K8 | --- | --- | --- |
| 3008 | 2K2 | 2K2 | --- | --- | --- |
| 4001 | --- | --- | JMP | JMP | JMP |
| 4002 | --- | --- | JMP | JMP | JMP |
| 4003 | --- | JMP | --- | --- | --- |
| 4004 | JMP | JMP | --- | --- | --- |
| 4012 | --- | JMP | --- | --- | --- |
| 6004 | 1SS356 | ISS356 | --- | --- | --- |
| 7001 | PDTC124 | PDTC124 | --- | --- | --- |

Tuner

| ITEM | LNA (AP) | AP | NA | LA/AP-NTSC |
|---|---|---|---|---|
| 1000 | UV1356A | TEDE9-228B | ENV56D98G3 TEDH9-200A | RTEDH9-200A UV1336 |
| 5001 | 47u | 47u | 27u | 5u6 |
| 5002 | 820n | --- | 820n | 820n |

0265 A4
0283 B2
0285 B2
0309 D8
1000 A3
1002 D7
1003 E7
1004 E7
2001 C3
2002 C4
2003 C5
2004 B5
2005 A5
2006 B6
2007 B6
2008 C5
2009 C8
2010 A4
3000 C3
3001 C3
3002 C6
3003 B7
3004 C7
3005 B7
3006 D5
3007 D5
3008 D5
3009 D6
3010 D3
3011 D4
4001 C5
4002 E7
4003 E6
4004 E7
4005 D6
4006 D5
4011 F7
4012 F7
5001 A6
5002 C5
5003 F8
6001 A5
6002 B6
6003 C6
6004 D5
6005 D6
7001 E5
7002 E6
9001 D6

## Mono Carrier: Video IF + Sound IF

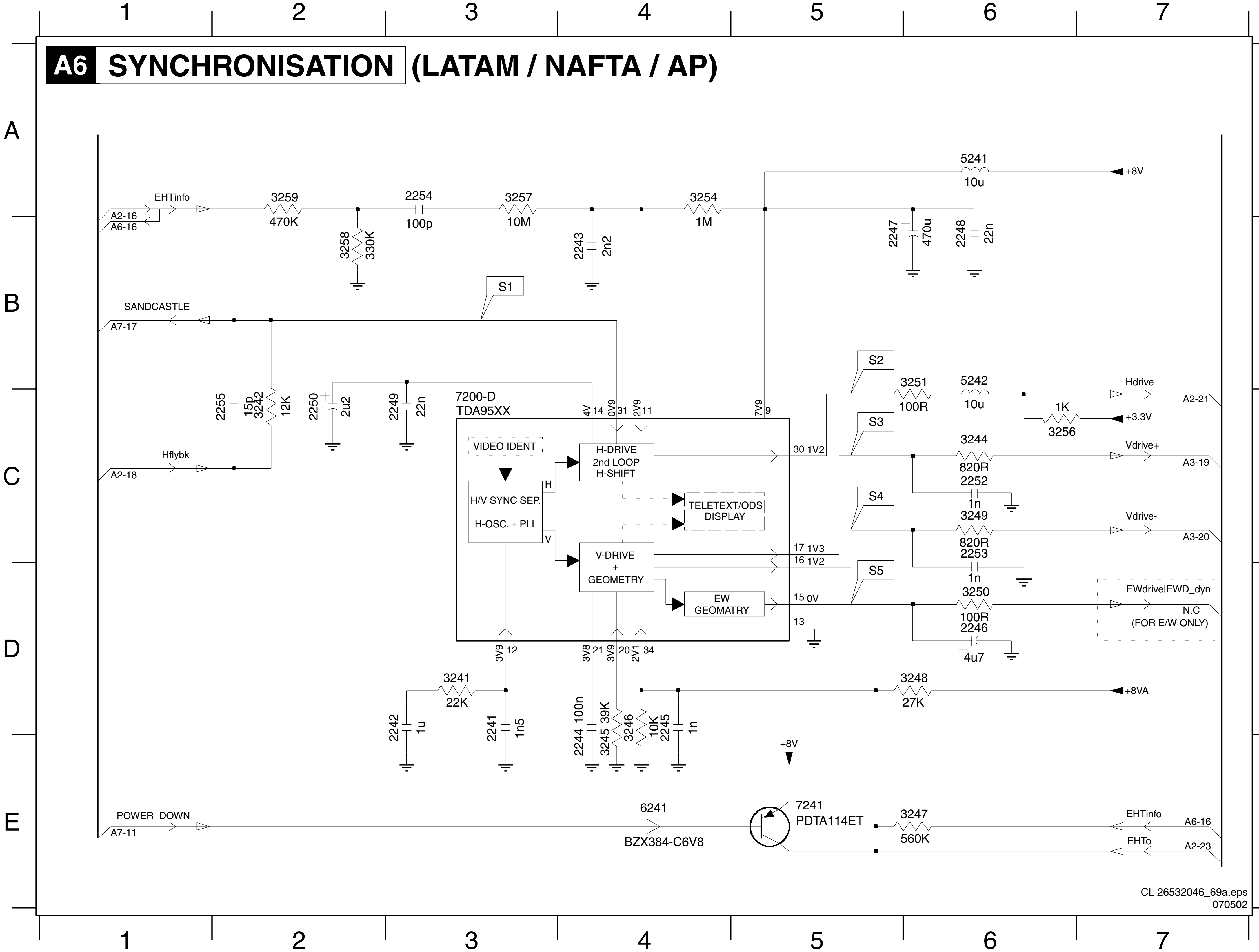



VIF

| ITEM | AP-multi-Inter | AP-Multi-QSS | AP-PAL | CHINA-PAL | NA/LA/AP-NTSC |
|---|---|---|---|---|---|
| 1200 | TP02 | 6M | TP04 | 6M | 4.5M |
| 1201 | --- | --- | 6.5M | 6.5M | --- |
| 1202 | 4.5M | --- | --- | --- | --- |
| 3208 | 150R | 390R | 220R | 390R | 220R |
| 3209 | 82R | 100R | 82R | 82R | 68R |
| 3210 | 4K7 | --- | --- | --- | --- |
| 3211 | 4K7 | --- | --- | --- | --- |
| 3213 | 470R | 560R | 470R | 560R | 560R |
| 5201 | 4u7 | 4u7 | 4u7 | 4u7 | 6u8 |
| 7202 | C857B | --- | --- | --- | --- |
| 7203 | C857B | --- | --- | --- | --- |
| 9694 | JMP | --- | --- | --- | --- |

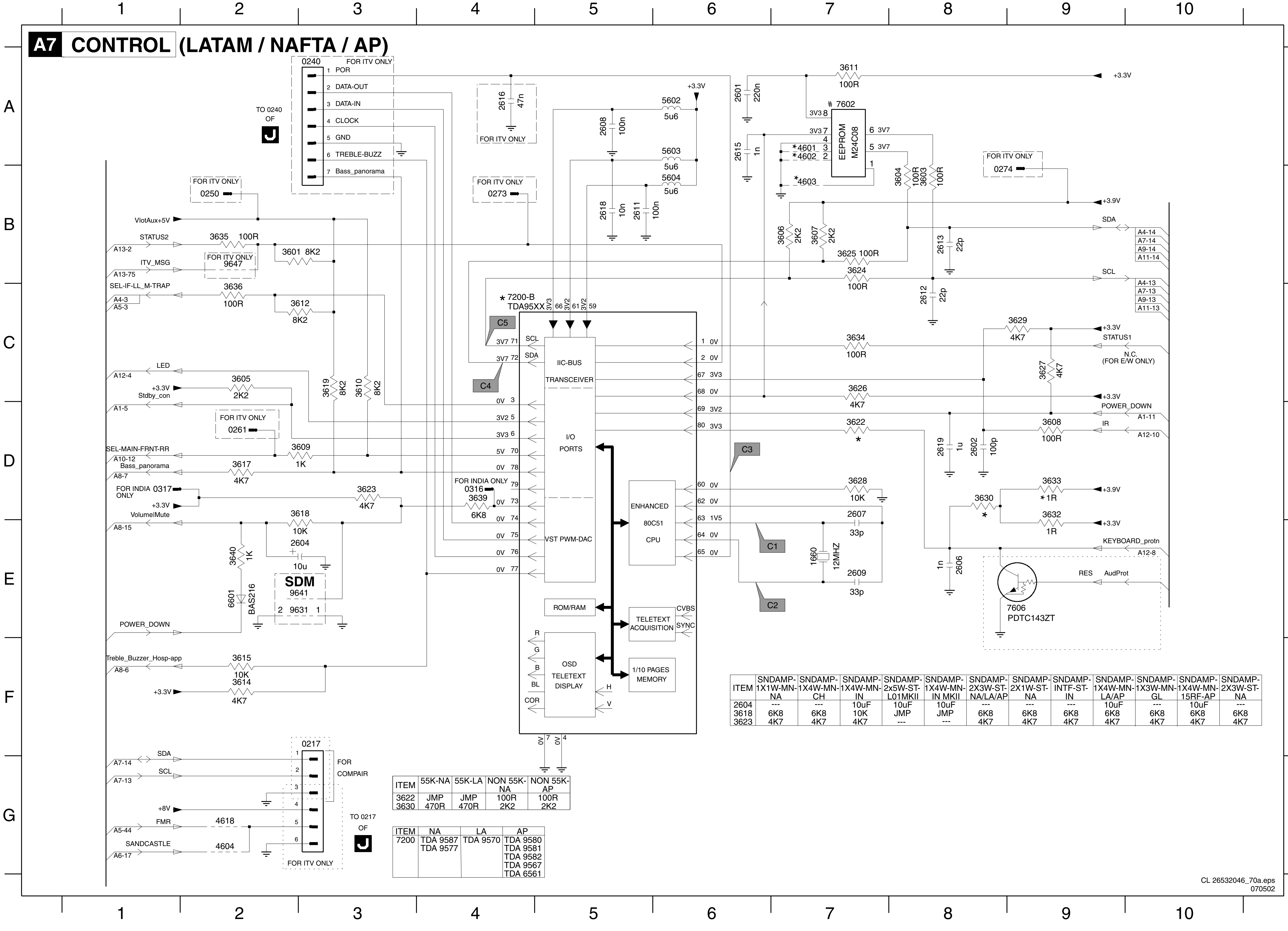
0243 C6
0248 C2
0249 B2
0266 E11
0276 C2
1200 D7
1201 E7
1202 E7
1203 F8
2201 C2
2202 C2
2203 D2
2204 D5
2205 B3
2208 B8
2209 F4
2210 G3
2211 D8
2212 B7
2213 E2
2214 E2
2215 F2
2216 A10
2217 A10
2219 B4
2220 A3
2221 B2
2222 F8
2223 F9
2225 C7
2226 C8
2227 C10
2228 C10
2229 C11
2230 C11
2233 E3
2234 F6
2235 E9
2236 F7
2237 G8
2238 F6
2239 G6
2240 F7
3200 A8
3201 B5
3202 C5
3203 C5
3204 E5
3205 E5
3206 F5
3207 C8
3208 D8
3209 D8
3210 E6
3211 E8
3212 D6
3213 D6
3214 C7
3215 B6
3216 A6
3217 F5
3218 G5
3219 G3
3220 A3
3221 A4
3222 A5
3223 F2
3224 F3
3225 F5
3226 E5
3228 A7
3229 C7
3230 B7
3231 A7
3232 C11
3233 F7
3234 E10
3235 E2
3236 F7
3237 F8
3238 G7
3239 G8
3240 F6
3261 F9
3637 C1
3638 D1
4203 B8
4204 C8
4205 E2
4206 F2
4207 E2
4209 D9
4210 B8
4211 B8
4212 B2
4213 B2
4214 D10
4216 F10
5201 D7
5202 A9
5207 B5
5208 C5
5209 C5
6201 F4
6202 F5
6206 G4
7200-A B9
7200-C C3
7201 D8
7202 E8
7203 E7
7204 F4
7205 A4
7206 B7
7208 C6
7209 F7
7210 F8
9200 D7
9298 F8
9618 A9
9625 F9

## Mono Carrier: Synchronisation




| | |
|---|---|
| 2241 | D3 |
| 2242 | D3 |
| 2243 | B4 |
| 2244 | E4 |
| 2245 | D4 |
| 2246 | D6 |
| 2247 | B5 |
| 2248 | B6 |
| 2249 | C3 |
| 2250 | C2 |
| 2252 | C6 |
| 2253 | C6 |
| 2254 | A3 |
| 2255 | C2 |
| 3241 | D3 |
| 3242 | C2 |
| 3244 | C6 |
| 3245 | E4 |
| 3246 | D4 |
| 3247 | E6 |
| 3248 | D6 |
| 3249 | C6 |
| 3250 | D6 |
| 3251 | B6 |
| 3254 | A4 |
| 3256 | C6 |
| 3257 | A3 |
| 3258 | B2 |
| 3259 | A2 |
| 5241 | A6 |
| 5242 | B6 |
| 6241 | E4 |
| 7200-D | C3 |
| 7241 | E5 |

## Mono Carrier: Control




| ITEM | SNDAMP-1X1W-MN-NA | SNDAMP-1X4W-MN-CH | SNDAMP-1X4W-MN-IN | SNDAMP-2x5W-ST-L01MKII | SNDAMP-1X4W-MN-IN MKII | SNDAMP-2X3W-ST-NA/LA/AP | SNDAMP-2X1W-ST-NA | SNDAMP-INTF-ST-IN | SNDAMP-1X4W-MN-LA/AP | SNDAMP-1X3W-MN-GL | SNDAMP-1X4W-MN-15RF-AP | SNDAMP-2X3W-ST-NA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2604 | --- | --- | 10uF | 10uF | 10uF | --- | --- | --- | 10uF | --- | 10uF | --- |
| 3618 | 6K8 | 6K8 | 10K | JMP | JMP | 6K8 | 6K8 | 6K8 | 6K8 | 6K8 | 6K8 | 6K8 |
| 3623 | 4K7 | 4K7 | 4K7 | --- | --- | 4K7 | 4K7 | 4K7 | 4K7 | 4K7 | 4K7 | 4K7 |

| ITEM | 55K-NA | 55K-LA | NON 55K-NA | NON 55K-AP |
|---|---|---|---|---|
| 3622 | JMP | JMP | 100R | 100R |
| 3630 | 470R | 470R | 2K2 | 2K2 |

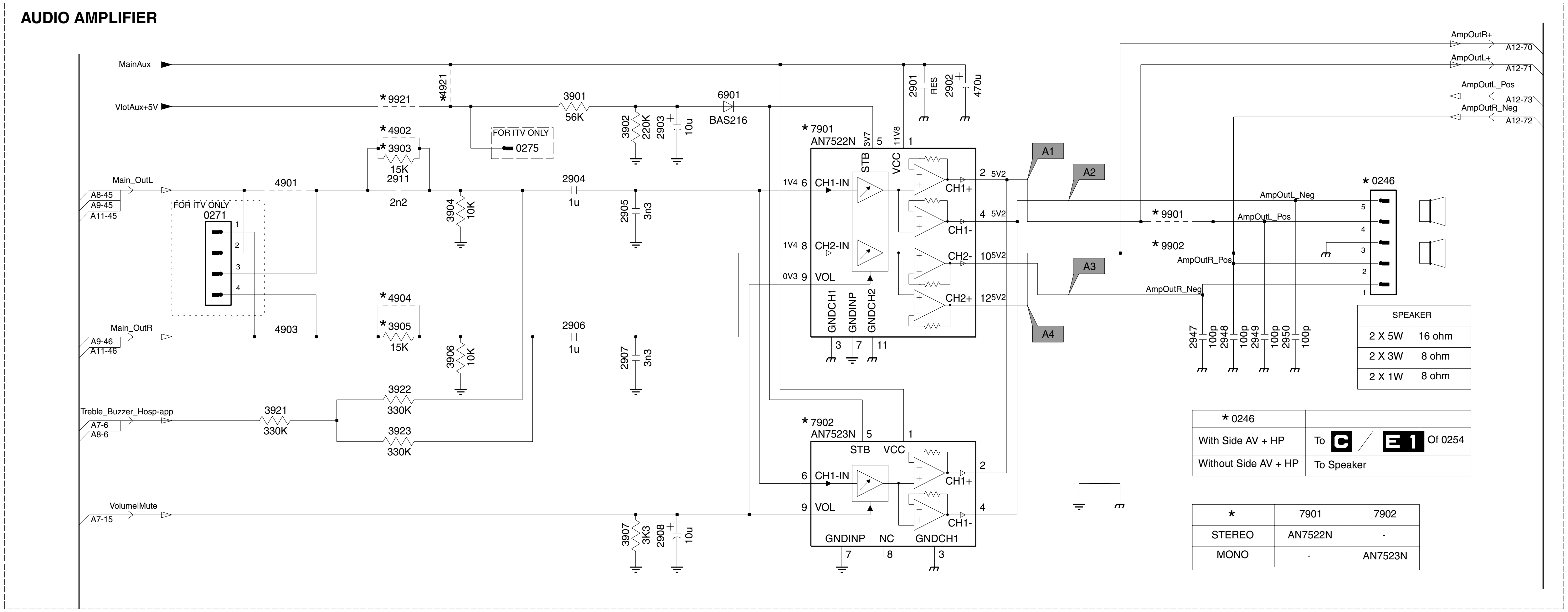
| ITEM | NA | LA | AP |
|---|---|---|---|
| 7200 | TDA 9587<br>TDA 9577 | TDA 9570 | TDA 9580<br>TDA 9581<br>TDA 9582<br>TDA 9567<br>TDA 6561 |

0217 F3
0240 A3
0250 B2
0261 D2
0273 B4
0274 B9
0316 D4
0317 D1
1660 E7
2601 A6
2602 D8
2604 E3
2606 E8
2607 D7
2608 A5
2609 E7
2611 B5
2612 C8
2613 B8
2615 A6
2616 A4
2618 B5
2619 D8
3601 B2
3603 B8
3604 B8
3605 C2
3606 B7
3607 B7
3608 D9
3609 D3
3610 C3
3611 A7
3612 C3
3614 F2
3615 F2
3617 D2
3618 D3
3619 C3
3622 D7
3623 D3
3624 B7
3625 B7
3626 C7
3627 C9
3628 D7
3629 C9
3630 D8
3632 D9
3633 D9
3634 C7
3635 B2
3636 C2
3639 D4
3640 E2
4601 A7
4602 A7
4603 B7
4604 G2
4618 G2
5602 A6
5603 A6
5604 B6
6601 E2
7200-B C4
7602 A7
7606 E9
9631 E3
9641 E3
9647 B2

## Mono Carrier: Audio Amplifier + Mono Sound Processing

# A8 AUDIO_AMPLIFIER + MONO_SOUND_PROCESSING

### AUDIO AMPLIFIER

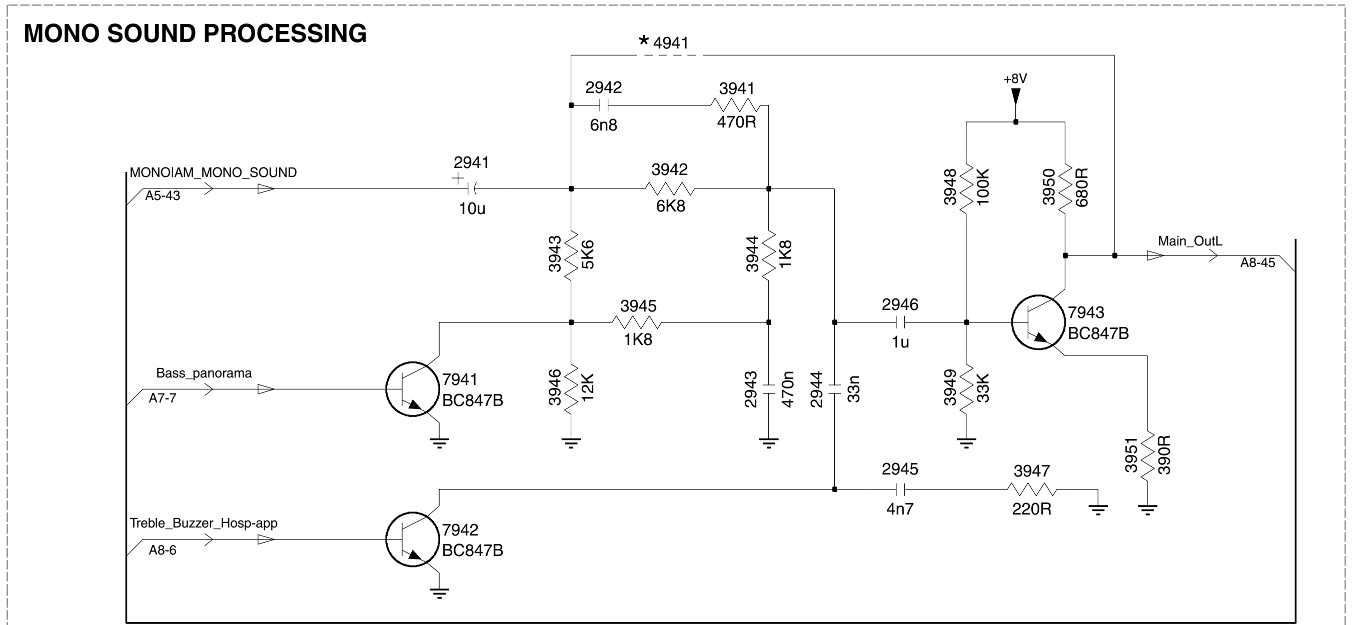



| SPEAKER | |
|---|---|
| 2 X 5W | 16 ohm |
| 2 X 3W | 8 ohm |
| 2 X 1W | 8 ohm |

| * 0246 | |
|---|---|
| With Side AV + HP | To C / E1 Of 0254 |
| Without Side AV + HP | To Speaker |

| * | 7901 | 7902 |
|---|---|---|
| STEREO | AN7522N | - |
| MONO | - | AN7523N |

### MONO SOUND PROCESSING




(Mono sets only)

| ITEM | WITH STEREO | WITHOUT STEREO | SNDPROC-SMART-MN-15RF-AP |
|---|---|---|---|
| 2941 | 1uF | 10uF | 1uF |
| 2942 | 33nF | --- | 33nF |
| 2943 | 100nF | --- | 100nF |
| 2944 | 47nF | --- | 39nF |
| 2945 | 10nF | --- | 4n7 |
| 2946 | 1uF | --- | 1uF |
| 3941 | 100R | --- | 100R |
| 3942 | 3K9 | --- | 4K7 |
| 3943 | 2K7 | --- | 2K7 |
| 3944 | 2K7 | --- | 2K7 |
| 3945 | 1K | --- | 1K |
| 3946 | 18K | --- | 8K2 |
| 3947 | 330R | --- | 10K |
| 3948 | 47K | --- | 47K |
| 3949 | 15K | --- | 15K |
| 3950 | 560R | --- | 560R |
| 3951 | 390R | --- | 390R |
| 4903 | JUMPER | --- | --- |
| 4941 | --- | JUMPER | --- |
| 7941 | BC847B | --- | BC847B |
| 7942 | BC847B | --- | BC847B |
| 7943 | BC847B | --- | BC847B |
| 9913 | JUMPER | --- | --- |
| 9914 | JUMPER | --- | --- |

| ITEM | SNDAMP-1X4W-MN-15RF-AP | SNDAMP-2X3W-ST-AP |
|---|---|---|
| 2904 | 1uF | 33nF |
| 2906 | --- | 33nF |
| 3903 | 10K | 3K3 |
| 3905 | --- | 3K3 |
| 3906 | --- | 10K |
| 7901 | YES | YES |
| 7902 | --- | --- |

| ITEM | 1X1 OR 2X1W-NA | 1X1W-MN | OTHERS |
|---|---|---|---|
| 2902 | 220uF/50V | 470uF/25V | 1000uF/16V |

| ITEM | IC-AN7522N | IC-AN7523N |
|---|---|---|
| 2907 | 1nF | --- |

| ITEM | SNDAMP-1X4W-MN-15RF-AP | OTHERS |
|---|---|---|
| 2911 | 2n2 | --- |

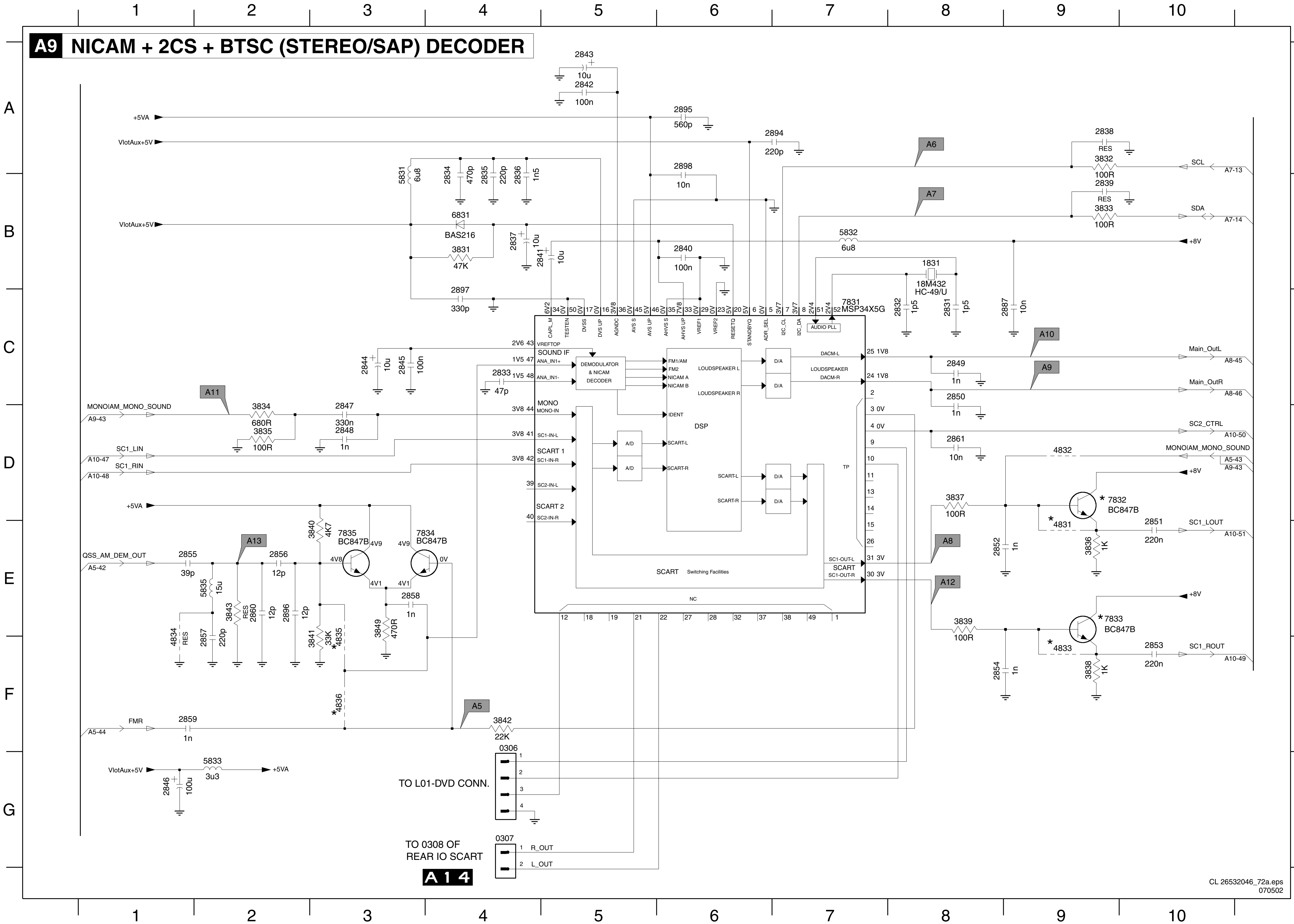
| ITEM | SNDAMP-1X1W-MN-NA | SNDAMP-1X4W-MN-CH | SNDAMP-1X4W-MN-IN | SNDAMP-2x5W-ST-L01MKII | SNDAMP-1X4W-MN-IN MKII | SNDAMP-2X3W-ST-NA/LA/AP |
|---|---|---|---|---|---|---|
| 2908 | 10uF | 10uF | --- | --- | --- | 10uF |

| ITEM | SNDAMP-2X1W-ST-NA | SNDAMP-INTF-ST-IN | SNDAMP-1X4W-MN-LA/AP | SNDAMP-1X3W-MN-GL | SNDAMP-1X4W-MN-15RF-AP | SNDAMP-2X3W-ST-NA |
|---|---|---|---|---|---|---|
| 2908 | 10uF | 10uF | --- | 10uF | --- | 10uF |

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070502

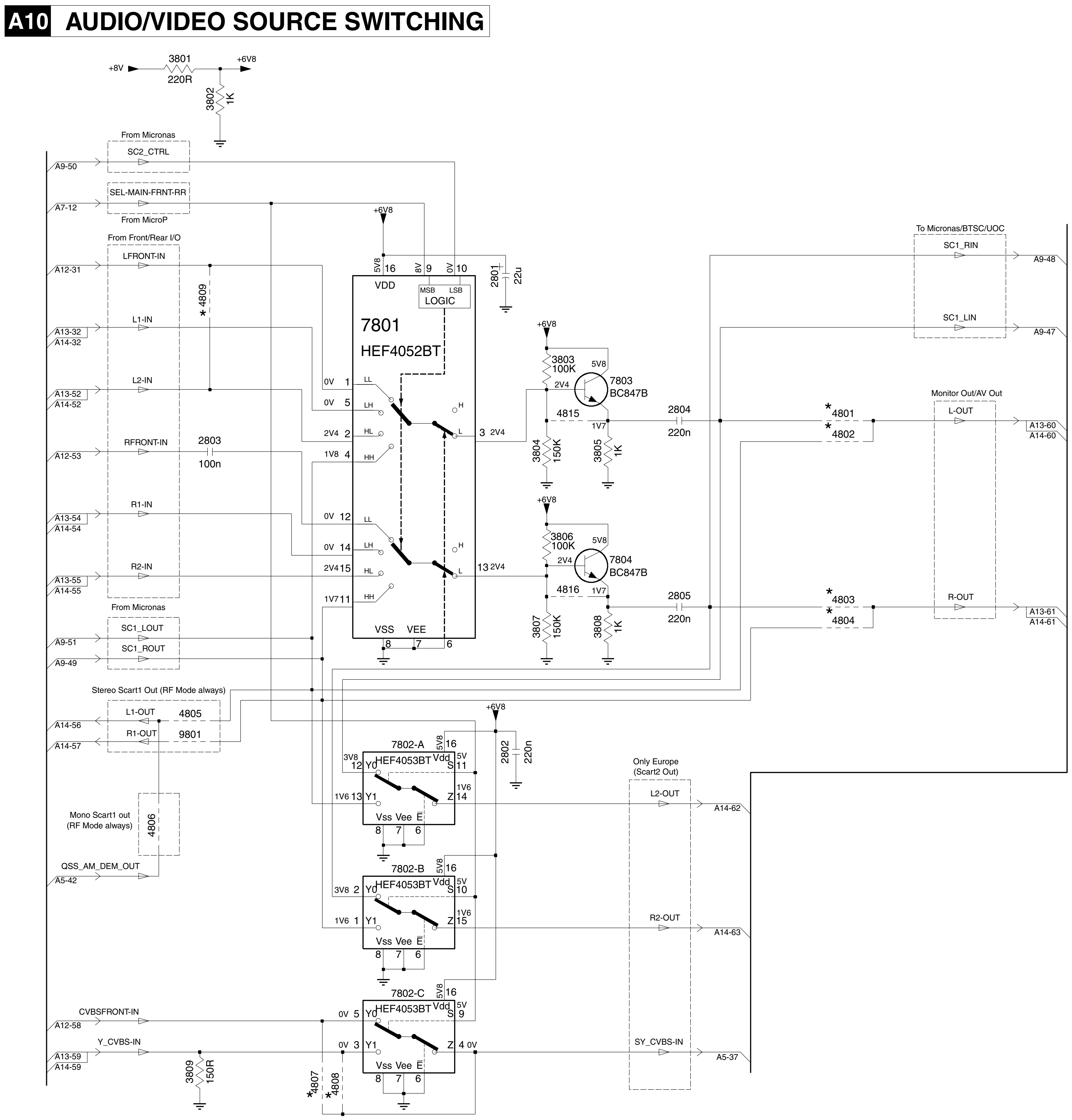
0246 B10
0271 B2
0275 B4
2901 A7
2902 A7
2903 A5
2904 B5
2905 B5
2906 C5
2907 C5
2908 D5
2911 B3
2941 F3
2942 E3
2943 G4
2944 G4
2945 G4
2946 F4
2947 C9
2948 C9
2949 C9
2950 C10
3901 A5
3902 A5
3903 B3
3904 B4
3905 C3
3906 C4
3907 D5
3921 C2
3922 C3
3923 D3
3941 E4
3942 F3
3943 F3
3944 F4
3945 F3
3946 G3
3947 G5
3948 F5
3949 G5
3950 F5
3951 G6
4901 B3
4902 A3
4903 C3
4904 C3
4921 A4
4941 E3
6901 A6
7901 A6
7902 C6
7941 G2
7942 G2
7943 F5
9901 B9
9902 B9
9921 A3

## Mono Carrier: NICAM +2CS + BTSC (Stereo/SAP) Decoder




| | |
|---|---|
| 0306 | F4 |
| 0307 | G4 |
| 1831 | B8 |
| 2831 | C8 |
| 2832 | C8 |
| 2833 | C4 |
| 2834 | B4 |
| 2835 | B4 |
| 2836 | B4 |
| 2837 | B4 |
| 2838 | A9 |
| 2839 | B9 |
| 2840 | B6 |
| 2841 | B5 |
| 2842 | A5 |
| 2843 | A5 |
| 2844 | C3 |
| 2845 | C3 |
| 2846 | G1 |
| 2847 | D3 |
| 2848 | D3 |
| 2849 | C8 |
| 2850 | C8 |
| 2851 | E10 |
| 2852 | E8 |
| 2853 | F10 |
| 2854 | F8 |
| 2855 | E1 |
| 2856 | E2 |
| 2857 | F2 |
| 2858 | E3 |
| 2859 | F1 |
| 2860 | E2 |
| 2861 | D8 |
| 2887 | C9 |
| 2894 | A7 |
| 2895 | A6 |
| 2896 | F2 |
| 2897 | C4 |
| 2898 | A6 |
| 3831 | B4 |
| 3832 | A9 |
| 3833 | B9 |
| 3834 | D2 |
| 3835 | D2 |
| 3836 | E9 |
| 3837 | D8 |
| 3838 | F9 |
| 3839 | E8 |
| 3840 | E3 |
| 3841 | F3 |
| 3842 | F4 |
| 3843 | E2 |
| 3849 | E3 |
| 4831 | E9 |
| 4832 | D9 |
| 4833 | F9 |
| 4834 | F1 |
| 4835 | F3 |
| 4836 | F3 |
| 5831 | B3 |
| 5832 | B7 |
| 5833 | G2 |
| 5835 | E2 |
| 6831 | B4 |
| 7831 | C7 |
| 7832 | D9 |
| 7833 | E9 |
| 7834 | E4 |
| 7835 | E3 |

## Mono Carrier: Audio/Video Source Switching




FOR EUROPE

| ITEM | 1x Scart With Front / Side Video | 2x Scart With Front / Side Video | 2x Scart W/O Front / Side Video |
|---|---|---|---|
| 3809 | x | 150R | 150R |
| 4807 | JUMPER | x | x |
| 4808 | x | x | JUMPER |

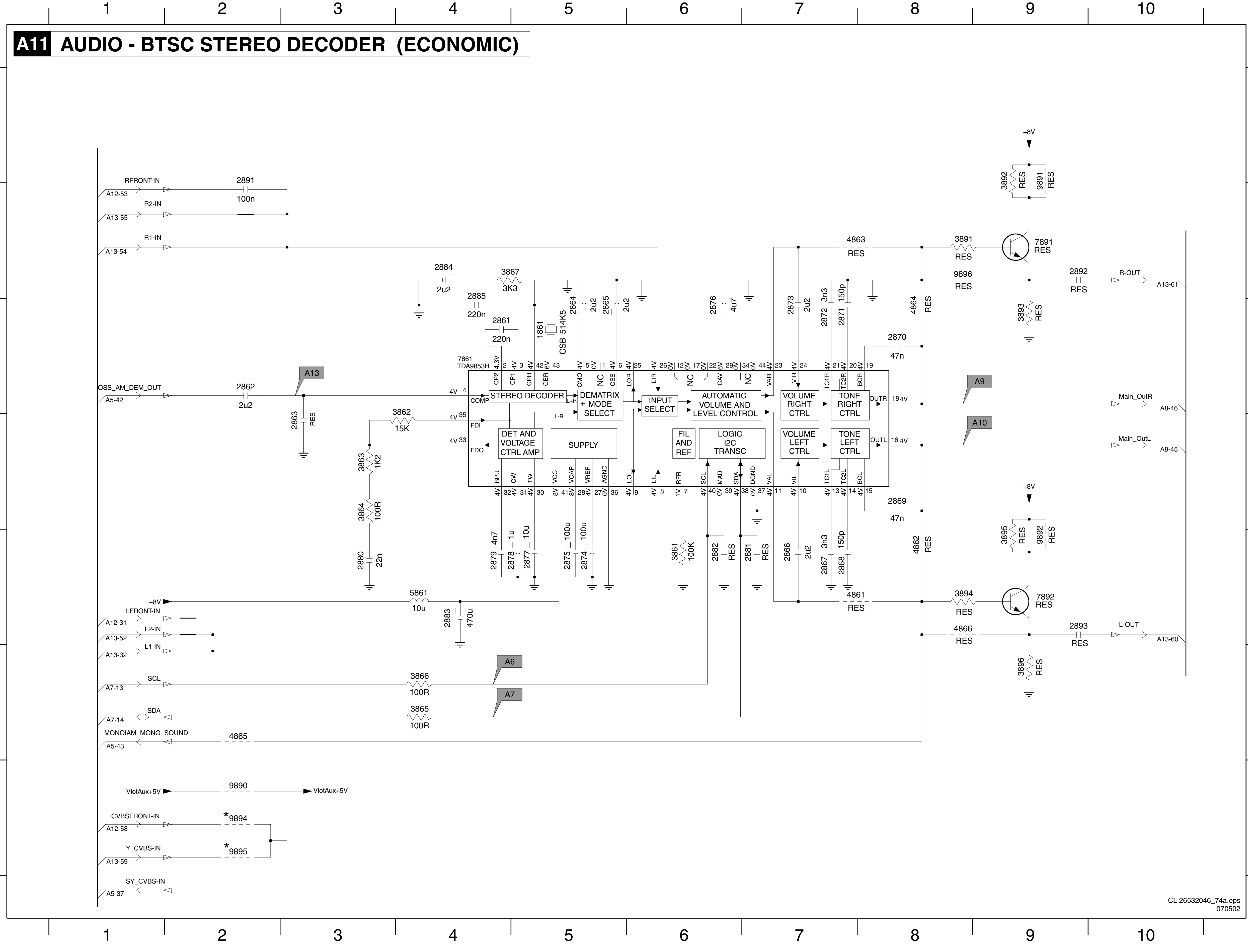
FOR AP/LATAM/NAFTA

| ITEM | 1x Rear Video In With Front or Side Video With SVHS / 2x Rear Video With Front Or Side Video | 1x Rear Video In With Front Or Side Video W/O SVHS / 1x Front Or Sideo Video IN | 2x Rear Video In W/O Front Or Side Video | No Video Input |
|---|---|---|---|---|
| 4807 | x | JUMPER | x | x |
| 4808 | x | x | JUMPER | x |
| 7802 | Y | x | x | x |

2801 B4
2802 F4
2803 C2
2804 C5
2805 E5
3801 A2
3802 A2
3803 C4
3804 D4
3805 D4
3806 D4
3807 E4
3808 E4
3809 H2
4801 C6
4802 C6
4803 E6
4804 E6
4805 E2
4806 F1
4807 H2
4808 H3
4809 B2
4815 C4
4816 E4
7801 C3
7802-A F3
7802-B F3
7802-C G3
7803 C5
7804 D5
9801 F2

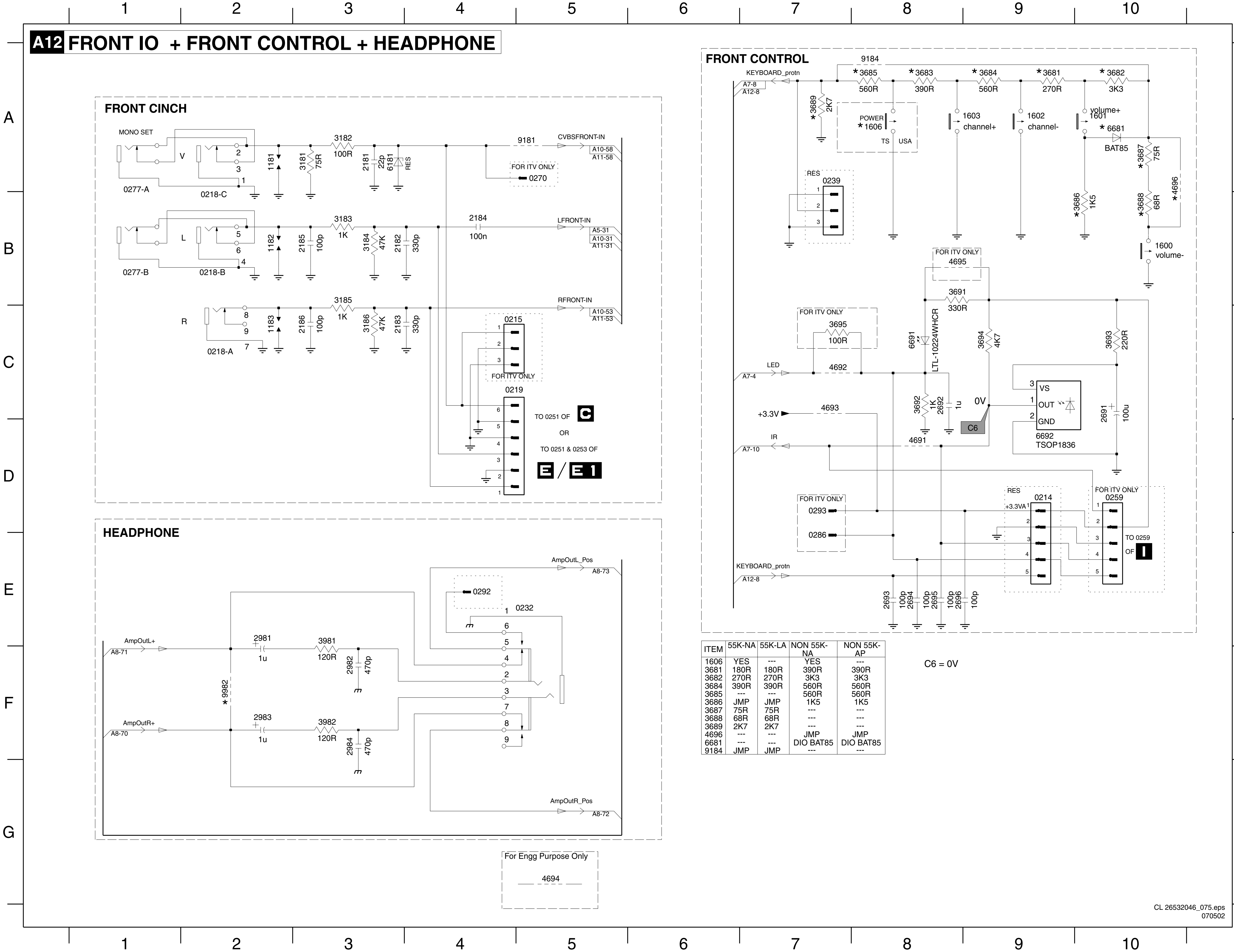
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070502

## Mono Carrier: Audio - BTSC Stereo Decoder (Economic)




| | |
|---|---|
| 1861 C5 | 2861 C4 |
| 2862 C2 | 2863 D3 |
| 2864 C5 | 2865 C5 |
| 2866 E7 | 2867 E7 |
| 2868 E7 | 2869 D8 |
| 2870 C8 | 2871 C7 |
| 2872 C7 | 2873 C7 |
| 2874 E5 | 2875 E5 |
| 2876 C6 | 2877 E5 |
| 2878 E5 | 2879 E4 |
| 2880 E3 | 2881 E7 |
| 2882 E6 | 2883 E4 |
| 2884 B4 | 2885 C4 |
| 2891 B2 | 2892 B9 |
| 2893 E9 | 3861 E6 |
| 3862 D4 | 3863 D3 |
| 3864 D3 | 3865 F4 |
| 3866 F4 | 3867 B4 |
| 3891 B8 | 3892 A9 |
| 3893 C9 | 3894 E8 |
| 3895 E9 | 3896 F9 |
| 4861 E7 | 4862 E8 |
| 4863 B7 | 4864 C8 |
| 4865 F2 | 4866 E8 |
| 5861 E4 | 7861 C4 |
| 7891 B9 | 7892 E9 |
| 9890 G2 | 9891 A9 |
| 9892 E9 | 9894 G2 |
| 9895 G2 | 9896 B8 |

## Mono Carrier: Front I/O + Front Control + Headphone

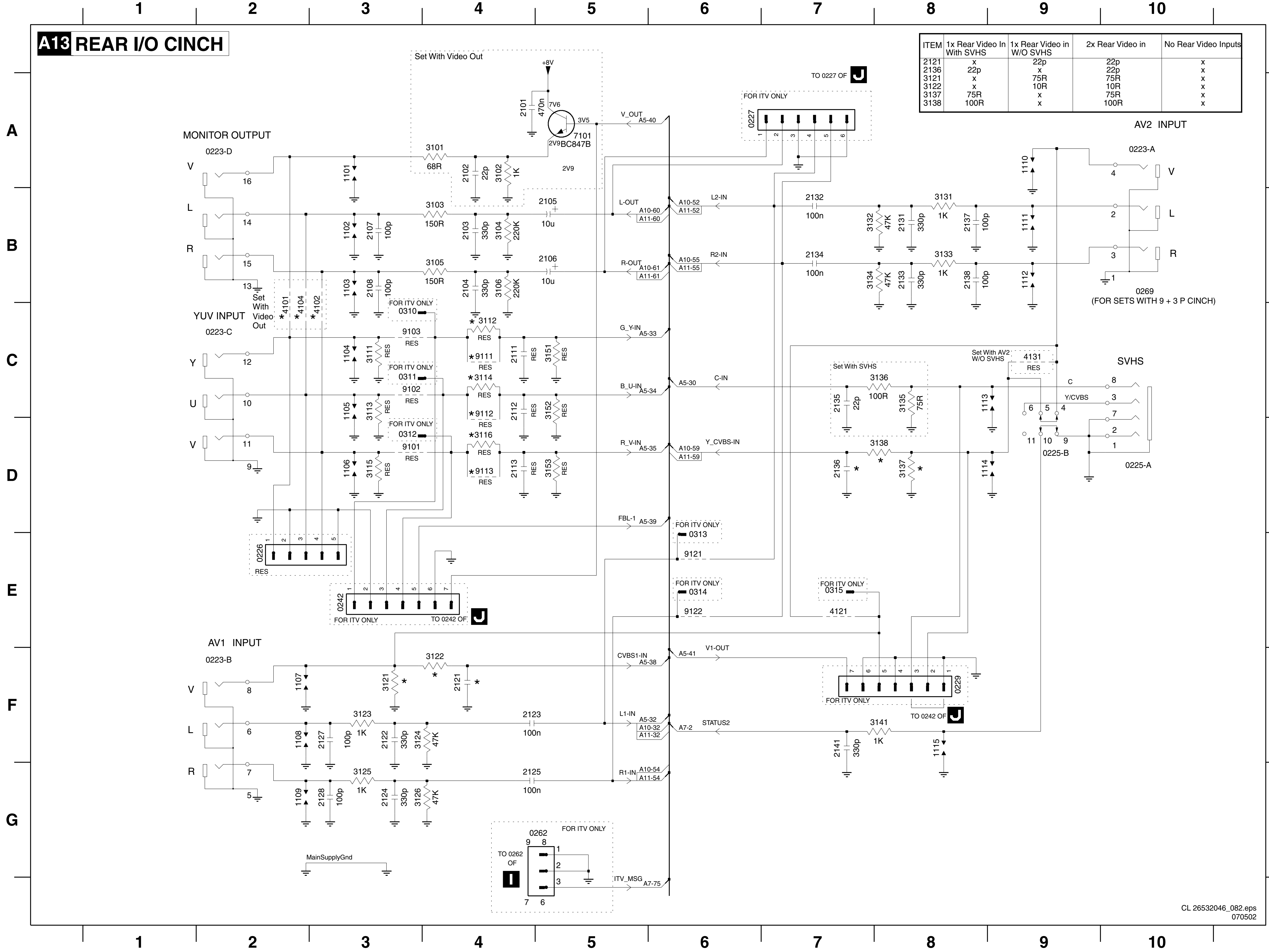



| ITEM | 55K-NA | 55K-LA | NON 55K-NA | NON 55K-AP |
|---|---|---|---|---|
| 1606 | YES | --- | YES | --- |
| 3681 | 180R | 180R | 390R | 390R |
| 3682 | 270R | 270R | 3K3 | 3K3 |
| 3684 | 390R | 390R | 560R | 560R |
| 3685 | --- | --- | 560R | 560R |
| 3686 | JMP | JMP | 1K5 | 1K5 |
| 3687 | 75R | 75R | --- | --- |
| 3688 | 68R | 68R | --- | --- |
| 3689 | 2K7 | 2K7 | --- | --- |
| 4696 | --- | --- | JMP | JMP |
| 6681 | --- | --- | DIO BAT85 | DIO BAT85 |
| 9184 | JMP | JMP | --- | --- |

C6 = 0V

0214 D9
0215 C4
0218-A C2
0218-B B2
0218-C A2
0219 C4
0232 E4
0239 A7
0259 D10
0270 A5
0277-A A1
0277-B B1
0286 E7
0292 E4
0293 D7
1181 A2
1182 B2
1183 C2
1600 B10
1601 A10
1602 A9
1603 A9
1606 A8
2181 A3
2182 B3
2183 C3
2184 B4
2185 B3
2186 C3
2691 C10
2692 C8
2693 E8
2694 E8
2695 E8
2696 E8
2981 E2
2982 F3
2983 F2
2984 F3
3181 A3
3182 A3
3183 B3
3184 B3
3185 B3
3186 C3
3681 A9
3682 A10
3683 A8
3684 A9
3685 A8
3686 B10
3687 A10
3688 B10
3689 A7
3691 B8
3692 C8
3693 C10
3694 C9
3695 C7
3981 E3
3982 F3
4691 D8
4692 C7
4693 C7
4694 G5
4695 B8
4696 A10
6181 A3
6681 A10
6691 C8
6692 D9
9181 A5
9184 A8
9982 F2

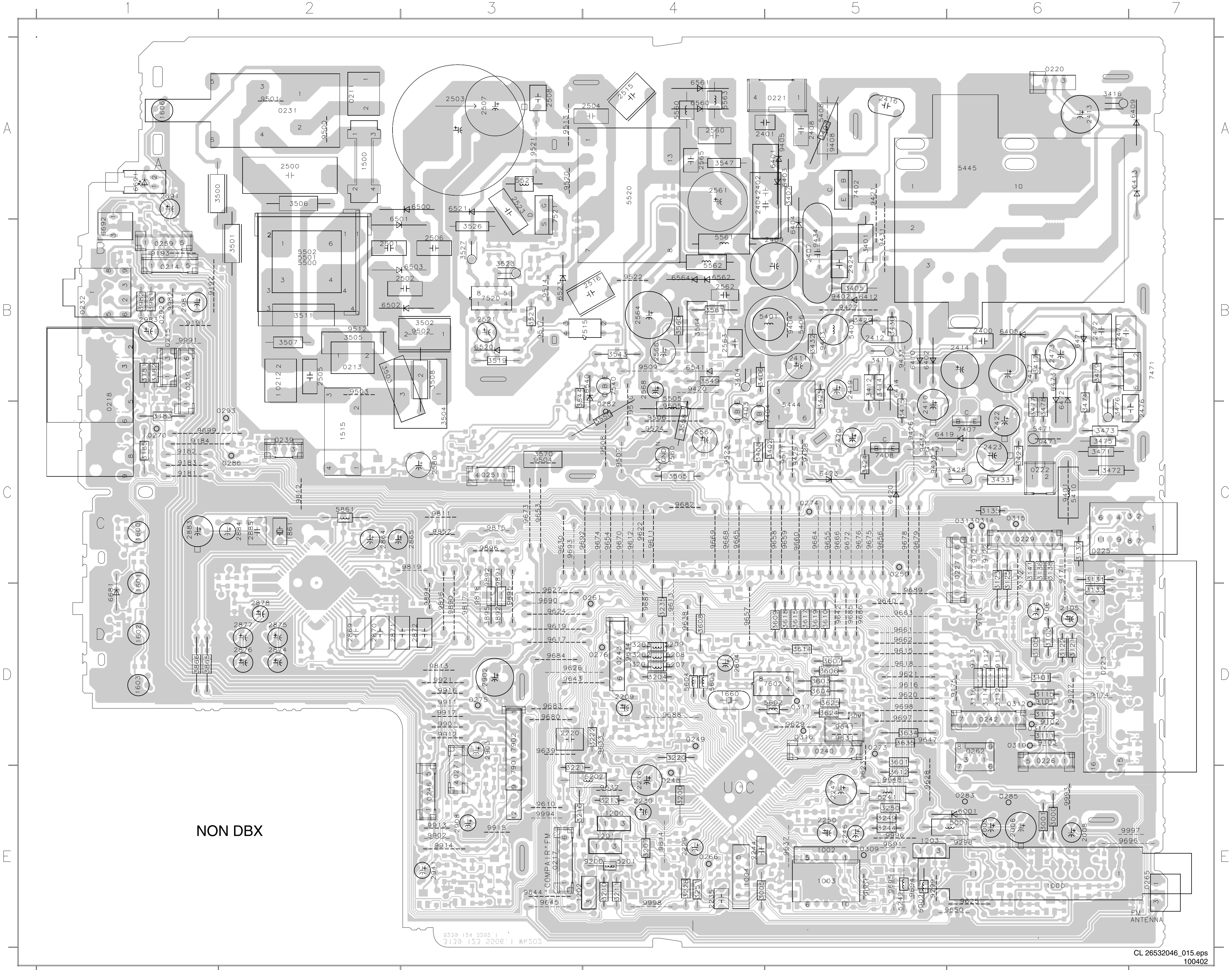
## Mono Carrier: Rear I/O Cinch




| ITEM | 1x Rear Video In With SVHS | 1x Rear Video in W/O SVHS | 2x Rear Video in | No Rear Video Inputs |
|---|---|---|---|---|
| 2121 | x | 22p | 22p | x |
| 2136 | 22p | x | 22p | x |
| 3121 | x | 75R | 75R | x |
| 3122 | x | 10R | 10R | x |
| 3137 | 75R | x | 75R | x |
| 3138 | 100R | x | 100R | x |

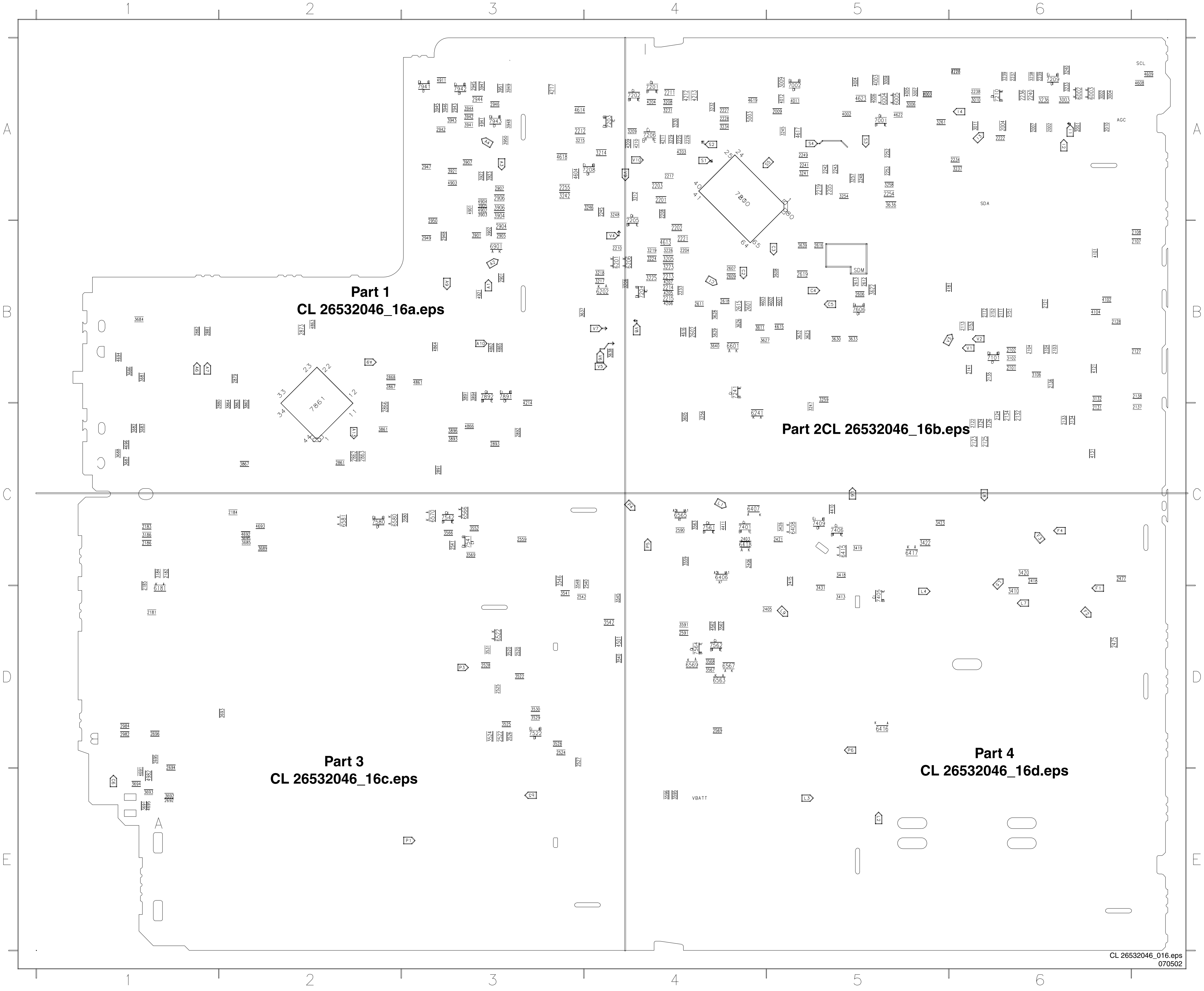
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0223-B F2
0223-C C2
0223-D A2
0225-A D10
0225-B D9
0226 E2
0227 A6
0229 F8
0242 E3
0262 G5
0310 C3
0311 C3
0312 D3
0313 E6
0314 E6
0315 E7
1101 A3
1102 B3
1103 B3
1104 C3
1105 C3
1106 D3
1107 F2
1108 F2
1109 G2
1110 A9
1111 B9
1112 B9
1113 C8
1114 D8
1115 F8
2101 A4
2102 A4
2103 B4
2104 B4
2105 B5
2106 B5
2107 B3
2108 B3
2111 C4
2112 C4
2113 D4
2121 F4
2122 F3
2123 F4
2124 G3
2125 G4
2127 F3
2128 G3
2131 B8
2132 B7
2133 B8
2134 B7
2135 C7
2136 D7
2137 B8
2138 B8
2141 F7
3101 A4
3102 A4
3103 B4
3104 B4
3105 B4
3106 B4
3111 C3
3112 C4
3113 C3
3114 C4
3115 D3
3116 D4
3121 F3
3122 F4
3123 F3
3124 F3
3125 G3
3126 G3
3131 B8
3132 B7
3133 B8
3134 B7
3135 C8
3136 C8
3137 D8
3138 D8
3141 F8
3151 C5
3152 C5
3153 D5
4101 C2
4102 C3
4104 C2
4121 E7
4131 C9
7101 A5
9101 D3
9102 C3
9103 C3
9111 C4
9112 C4
9113 D4
9121 E6
9122 E6

# Layout Mono Carrier Non DBX (Top Side)



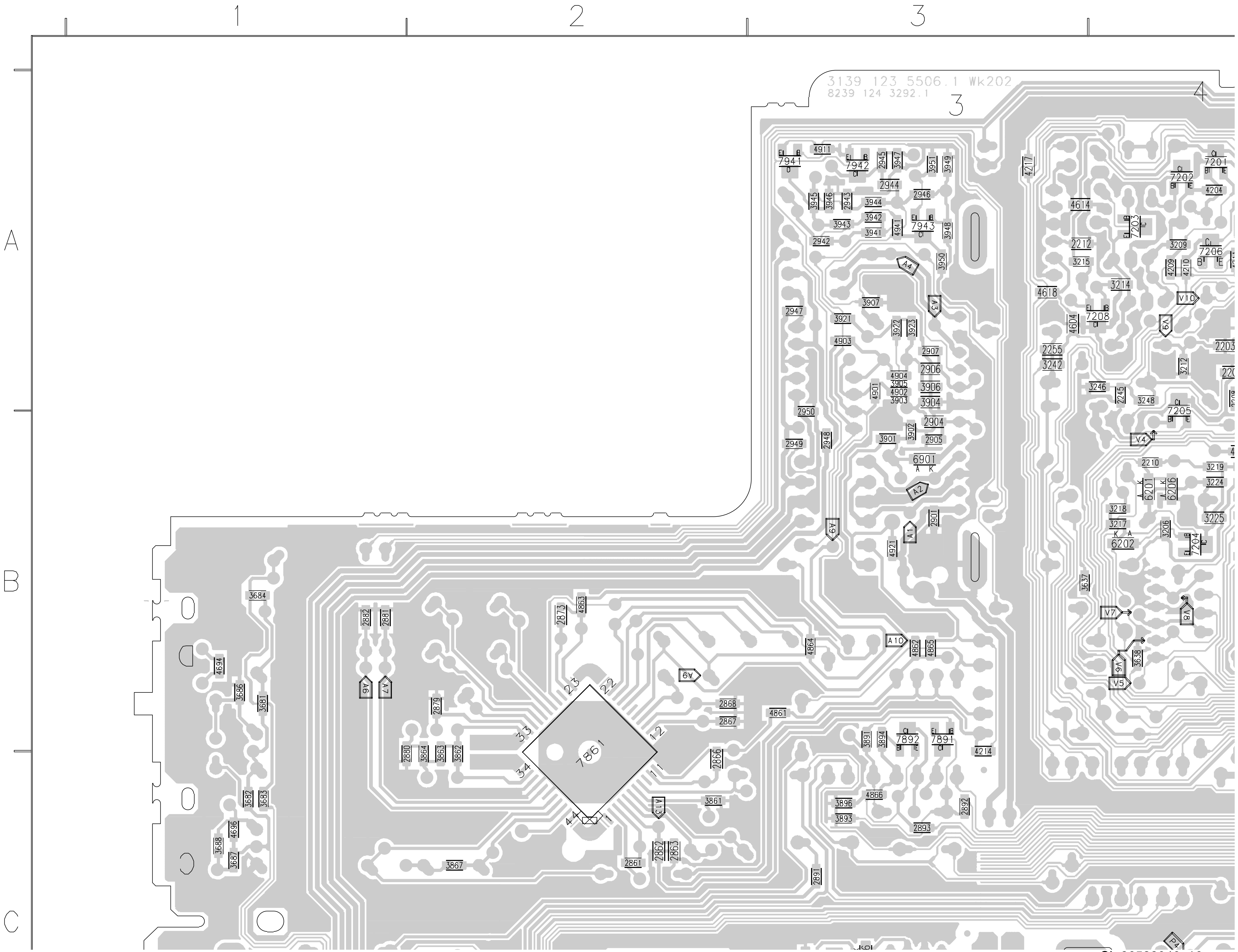

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| 0212 | B2 | 3005 | E4 | 5604 | D4 | 9658 | C5 |
| 0213 | B2 | 3101 | D6 | 5861 | C2 | 9659 | C5 |
| 0214 | B1 | 3103 | D6 | 6001 | E6 | 9660 | C5 |
| 0215 | B1 | 3105 | D6 | 6401 | A5 | 9661 | D5 |
| 0217 | E3 | 3111 | D6 | 6402 | B5 | 9662 | D5 |
| 0218 | C1 | 3112 | D6 | 6403 | A5 | 9663 | D5 |
| 0219 | B1 | 3113 | D6 | 6404 | B5 | 9664 | C5 |
| 0220 | A6 | 3114 | D6 | 6405 | B6 | 9665 | C4 |
| 0221 | A5 | 3115 | D6 | 6409 | A7 | 9666 | C5 |
| 0222 | C6 | 3116 | D6 | 6410 | B5 | 9668 | C4 |
| 0223 | D6 | 3121 | D6 | 6412 | B5 | 9669 | C4 |
| 0225 | C6 | 3122 | D6 | 6413 | A7 | 9670 | C4 |
| 0226 | D6 | 3123 | C6 | 6414 | B5 | 9672 | C5 |
| 0227 | C6 | 3125 | C6 | 6419 | C5 | 9673 | C3 |
| 0229 | C6 | 3131 | C6 | 6420 | C5 | 9674 | C4 |
| 0231 | A2 | 3133 | D6 | 6423 | C5 | 9675 | C5 |
| 0232 | B1 | 3135 | C6 | 6471 | B6 | 9676 | C5 |
| 0239 | C2 | 3136 | C6 | 6472 | B6 | 9678 | C5 |
| 0240 | D5 | 3137 | C6 | 6473 | B6 | 9679 | C5 |
| 0242 | D6 | 3138 | C6 | 6500 | A3 | 9680 | D3 |
| 0243 | D4 | 3141 | C6 | 6501 | A2 | 9682 | C4 |
| 0246 | E3 | 3181 | B1 | 6502 | B2 | 9683 | D3 |
| 0248 | E4 | 3182 | B1 | 6503 | B3 | 9684 | D3 |
| 0249 | D4 | 3183 | C1 | 6520 | B3 | 9685 | D5 |
| 0250 | C5 | 3185 | C1 | 6521 | A3 | 9686 | D5 |
| 0251 | C3 | 3200 | E4 | 6523 | B3 | 9687 | D4 |
| 0259 | B1 | 3201 | D4 | 6540 | B4 | 9688 | D4 |
| 0261 | D4 | 3202 | D4 | 6541 | B4 | 9689 | D5 |
| 0262 | D6 | 3203 | D4 | 6560 | A4 | 9690 | D3 |
| 0265 | E7 | 3204 | D4 | 6561 | A4 | 9691 | E5 |
| 0266 | E4 | 3207 | E4 | 6562 | B4 | 9692 | C3 |
| 0270 | C1 | 3210 | E4 | 6564 | B4 | 9693 | C3 |
| 0271 | E3 | 3211 | E4 | 6681 | D1 | 9694 | E5 |
| 0273 | D5 | 3213 | E4 | 6691 | A1 | 9695 | E5 |
| 0274 | C5 | 3216 | E3 | 6692 | B1 | 9696 | E6 |
| 0275 | D3 | 3220 | D4 | 7402 | A5 | 9697 | D5 |
| 0276 | D4 | 3221 | E3 | 7403 | C4 | 9698 | D5 |
| 0277 | B1 | 3222 | D4 | 7404 | C5 | 9699 | C1 |
| 0282 | C4 | 3228 | E4 | 7407 | C6 | 9811 | C3 |
| 0283 | E6 | 3235 | D4 | 7408 | C5 | 9812 | C2 |
| 0285 | E6 | 3244 | E5 | 7471 | B7 | 9813 | D3 |
| 0286 | C2 | 3249 | E5 | 7515 | B4 | 9815 | C3 |
| 0292 | B1 | 3250 | E5 | 7520 | B3 | 9816 | D3 |
| 0293 | C2 | 3251 | E4 | 7521 | A3 | 9817 | D3 |
| 0309 | E5 | 3401 | B5 | 7540 | B4 | 9818 | D3 |
| 0310 | D6 | 3402 | C5 | 7560 | C4 | 9819 | C3 |
| 0311 | D6 | 3403 | A5 | 7602 | D5 | 9852 | C3 |
| 0312 | D6 | 3404 | B4 | 7901 | D3 | 9890 | D3 |
| 0313 | C6 | 3405 | B5 | 7902 | D3 | 9891 | C3 |
| 0314 | C6 | 3406 | B4 | 9001 | E5 | 9892 | C3 |
| 0315 | C6 | 3407 | A5 | 9101 | D6 | 9894 | D3 |
| 0316 | D5 | 3408 | C4 | 9102 | D6 | 9895 | D3 |
| 0317 | D5 | 3411 | B5 | 9103 | D6 | 9896 | C3 |
| 1000 | E6 | 3412 | B5 | 9111 | D6 | 9901 | D3 |
| 1002 | E5 | 3414 | B5 | 9112 | D6 | 9902 | E3 |
| 1003 | E5 | 3415 | C5 | 9113 | D6 | 9911 | D3 |
| 1004 | E4 | 3416 | A6 | 9121 | C6 | 9912 | D3 |
| 1200 | E4 | 3417 | B6 | 9122 | C6 | 9913 | E3 |
| 1201 | E4 | 3421 | C5 | 9171 | C6 | 9914 | E3 |
| 1202 | E3 | 3424 | C5 | 9172 | C6 | 9915 | E3 |
| 1203 | E5 | 3425 | B5 | 9173 | D6 | 9916 | D3 |
| 1500 | A2 | 3427 | C6 | 9174 | D6 | 9917 | D3 |
| 1515 | C2 | 3428 | C6 | 9175 | D6 | 9921 | D3 |
| 1600 | C1 | 3429 | B5 | 9177 | D6 | 9982 | B1 |
| 1601 | C1 | 3430 | B5 | 9181 | C1 | 9991 | B1 |
| 1602 | D1 | 3432 | B5 | 9182 | C1 | 9993 | E6 |
| 1603 | D1 | 3433 | C6 | 9183 | C1 | 9994 | E3 |
| 1606 | A1 | 3471 | C6 | 9184 | C1 | 9996 | E5 |
| 1660 | D4 | 3472 | C6 | 9191 | B1 | 9997 | E7 |
| 1861 | C2 | 3473 | C6 | 9192 | B1 | 9998 | E4 |
| 2005 | E6 | 3474 | C6 | 9193 | B1 | | |
| 2006 | E6 | 3475 | C6 | 9200 | E4 | | |
| 2008 | E6 | 3476 | C6 | 9298 | E6 | | |
| 2105 | D6 | 3477 | C6 | 9299 | E5 | | |
| 2106 | D6 | 3478 | C6 | 9401 | C6 | | |
| 2209 | D4 | 3479 | B6 | 9402 | B5 | | |
| 2216 | E4 | 3500 | A1 | 9403 | B5 | | |
| 2220 | D3 | 3501 | B2 | 9404 | B5 | | |
| 2229 | E4 | 3502 | B3 | 9405 | A5 | | |
| 2230 | E4 | 3503 | B2 | 9408 | A5 | | |
| 2235 | E4 | 3504 | C3 | 9420 | B4 | | |
| 2244 | E4 | 3505 | B2 | 9421 | A5 | | |
| 2246 | E5 | 3506 | A2 | 9425 | C5 | | |
| 2247 | E5 | 3507 | B2 | 9426 | C5 | | |
| 2250 | E5 | 3508 | B3 | 9427 | B5 | | |
| 2400 | B6 | 3511 | B2 | 9428 | C5 | | |
| 2401 | A5 | 3519 | B3 | 9430 | C5 | | |
| 2402 | A4 | 3521 | B3 | 9431 | B5 | | |
| 2404 | A4 | 3523 | B3 | 9432 | C5 | | |
| 2407 | B5 | 3526 | B3 | 9433 | B5 | | |
| 2408 | A5 | 3527 | B3 | 9434 | B5 | | |
| 2409 | B5 | 3543 | B4 | 9471 | C6 | | |
| 2410 | C5 | 3544 | B3 | 9500 | A2 | | |
| 2411 | B5 | 3547 | A4 | 9501 | A2 | | |
| 2412 | B5 | 3549 | B4 | 9502 | B3 | | |
| 2413 | A6 | 3550 | C4 | 9503 | B2 | | |
| 2414 | B6 | 3558 | C4 | 9504 | C3 | | |
| 2416 | A5 | 3560 | B4 | 9505 | C4 | | |
| 2417 | B6 | 3561 | B4 | 9506 | C4 | | |
| 2419 | B5 | 3564 | B4 | 9507 | C4 | | |
| 2420 | C5 | 3565 | C4 | 9508 | C4 | | |
| 2422 | C6 | 3570 | C3 | 9509 | B4 | | |
| 2423 | C6 | 3601 | D5 | 9510 | C4 | | |
| 2424 | B5 | 3603 | D5 | 9511 | C5 | | |
| 2471 | B6 | 3604 | D5 | 9512 | B2 | | |
| 2472 | B6 | 3606 | D5 | 9513 | A3 | | |
| 2473 | B6 | 3607 | D5 | 9514 | B3 | | |
| 2476 | C7 | 3608 | D4 | 9517 | B3 | | |
| 2500 | A2 | 3609 | D5 | 9520 | A3 | | |
| 2501 | B2 | 3610 | D5 | 9521 | A3 | | |
| 2502 | B3 | 3612 | E5 | 9522 | B4 | | |
| 2503 | A3 | 3614 | D5 | 9523 | C4 | | |
| 2504 | A4 | 3615 | D5 | 9524 | C4 | | |
| 2505 | B2 | 3617 | D5 | 9610 | E3 | | |
| 2506 | B3 | 3618 | D5 | 9611 | C4 | | |
| 2507 | A3 | 3619 | D5 | 9612 | C4 | | |
| 2508 | A3 | 3624 | D5 | 9613 | D4 | | |
| 2515 | A4 | 3625 | D5 | 9614 | E4 | | |
| 2516 | B4 | 3634 | D5 | 9615 | D5 | | |
| 2521 | B3 | 3635 | D5 | 9616 | D5 | | |
| 2523 | A3 | 3865 | D1 | 9617 | D3 | | |
| 2560 | A4 | 3866 | D1 | 9618 | D5 | | |
| 2561 | A4 | 3892 | D3 | 9619 | D3 | | |
| 2562 | B4 | 3895 | D3 | 9620 | D5 | | |
| 2563 | B4 | 3981 | B1 | 9621 | D5 | | |
| 2564 | B4 | 3982 | B1 | 9622 | C4 | | |
| 2565 | A4 | 5001 | E6 | 9623 | E5 | | |
| 2566 | B4 | 5002 | E5 | 9624 | D3 | | |
| 2567 | C4 | 5201 | E4 | 9625 | E6 | | |
| 2568 | B4 | 5202 | E4 | 9626 | D3 | | |
| 2580 | C3 | 5207 | D4 | 9627 | D3 | | |
| 2604 | D4 | 5208 | D4 | 9628 | E5 | | |
| 2691 | A1 | 5209 | D4 | 9629 | D5 | | |
| 2864 | C2 | 5241 | E5 | 9630 | C3 | | |
| 2865 | C3 | 5242 | E5 | 9631 | D5 | | |
| 2869 | D2 | 5401 | B5 | 9632 | E4 | | |
| 2870 | D2 | 5403 | B5 | 9633 | D4 | | |
| 2871 | D2 | 5406 | B5 | 9634 | D4 | | |
| 2872 | D3 | 5408 | A5 | 9637 | E5 | | |
| 2874 | D2 | 5410 | C6 | 9638 | D4 | | |
| 2875 | D2 | 5444 | C5 | 9639 | D3 | | |
| 2876 | D2 | 5445 | A6 | 9640 | D5 | | |
| 2877 | D2 | 5471 | C6 | 9641 | D5 | | |
| 2878 | D2 | 5500 | B2 | 9642 | D5 | | |
| 2883 | C1 | 5501 | B2 | 9643 | D3 | | |
| 2884 | C2 | 5502 | B2 | 9644 | E3 | | |
| 2885 | C2 | 5505 | B4 | 9645 | E3 | | |
| 2902 | D3 | 5520 | A4 | 9647 | D5 | | |
| 2903 | D3 | 5521 | A3 | 9648 | E5 | | |
| 2908 | E3 | 5560 | A4 | 9650 | E6 | | |
| 2941 | E3 | 5561 | B4 | 9653 | C3 | | |
| 2981 | B1 | 5562 | B4 | 9654 | C4 | | |
| 2983 | B1 | 5563 | A4 | 9655 | C5 | | |
| 3000 | E6 | 5602 | D5 | 9656 | C5 | | |

## Layout Mono Carrier Non DBX (Overview Bottom Side)




| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2001 | A6 | 2694 | D1 | 3548 | C3 | 4616 | B4 |
| 2002 | A6 | 2695 | D1 | 3552 | C3 | 4617 | A5 |
| 2003 | A5 | 2696 | D1 | 3559 | C4 | 4618 | A3 |
| 2004 | A6 | 2861 | C2 | 3562 | D4 | 4619 | A4 |
| 2007 | A6 | 2862 | C2 | 3563 | C4 | 4622 | A5 |
| 2009 | A5 | 2863 | C2 | 3566 | C3 | 4623 | A5 |
| 2010 | A6 | 2866 | C2 | 3567 | D4 | 4691 | E1 |
| 2101 | B6 | 2867 | B2 | 3568 | D4 | 4692 | C2 |
| 2102 | B6 | 2868 | B2 | 3569 | C3 | 4693 | C2 |
| 2103 | B6 | 2873 | B2 | 3580 | C3 | 4694 | B1 |
| 2104 | B6 | 2879 | B2 | 3591 | D4 | 4695 | E1 |
| 2107 | B7 | 2880 | C1 | 3595 | E4 | 4696 | C1 |
| 2108 | B7 | 2881 | B1 | 3596 | E4 | 4861 | B3 |
| 2111 | B6 | 2882 | B1 | 3605 | C4 | 4862 | B3 |
| 2112 | B6 | 2891 | C3 | 3611 | B4 | 4863 | B2 |
| 2113 | B6 | 2892 | C3 | 3622 | B5 | 4864 | B3 |
| 2121 | B6 | 2893 | C3 | 3623 | B5 | 4865 | B3 |
| 2122 | C6 | 2901 | B3 | 3626 | B4 | 4866 | C3 |
| 2123 | C6 | 2904 | B3 | 3627 | B4 | 4901 | A3 |
| 2124 | C6 | 2905 | B3 | 3628 | B4 | 4902 | A3 |
| 2125 | C6 | 2906 | A3 | 3629 | B4 | 4903 | A3 |
| 2127 | B7 | 2907 | A3 | 3630 | B5 | 4904 | A3 |
| 2128 | B6 | 2942 | A3 | 3632 | B5 | 4911 | A3 |
| 2131 | C6 | 2943 | A3 | 3633 | B5 | 4921 | B3 |
| 2132 | C6 | 2944 | A3 | 3636 | A5 | 4941 | A3 |
| 2133 | C6 | 2945 | A3 | 3637 | B3 | 4982 | E1 |
| 2134 | C6 | 2946 | A3 | 3638 | B4 | 5003 | A4 |
| 2135 | B6 | 2947 | A3 | 3639 | B5 | 6002 | A6 |
| 2136 | B6 | 2948 | B3 | 3640 | B4 | 6003 | A6 |
| 2137 | C7 | 2949 | B3 | 3681 | B1 | 6004 | A5 |
| 2138 | B7 | 2950 | B3 | 3682 | C1 | 6005 | A5 |
| 2141 | B6 | 2982 | D1 | 3683 | C1 | 6181 | D1 |
| 2181 | D1 | 2984 | D1 | 3684 | B1 | 6201 | B4 |
| 2182 | C1 | 3002 | A6 | 3685 | C2 | 6202 | B4 |
| 2183 | C1 | 3003 | A6 | 3686 | B1 | 6206 | B4 |
| 2184 | C2 | 3004 | A6 | 3687 | C1 | 6241 | C4 |
| 2185 | D1 | 3006 | A5 | 3688 | C1 | 6406 | C4 |
| 2186 | C1 | 3007 | A5 | 3689 | C2 | 6407 | C4 |
| 2201 | A4 | 3008 | A5 | 3691 | E1 | 6408 | C5 |
| 2202 | B4 | 3009 | A5 | 3692 | E1 | 6415 | C5 |
| 2203 | A4 | 3010 | A6 | 3693 | E1 | 6416 | D5 |
| 2204 | B4 | 3011 | A6 | 3694 | E1 | 6417 | C5 |
| 2205 | A5 | 3102 | B6 | 3695 | C2 | 6418 | C4 |
| 2208 | A4 | 3104 | B6 | 3861 | C2 | 6522 | D3 |
| 2210 | B4 | 3106 | B6 | 3862 | C2 | 6563 | D4 |
| 2211 | A4 | 3124 | C6 | 3863 | C2 | 6565 | C4 |
| 2212 | A3 | 3126 | C6 | 3864 | C2 | 6566 | C3 |
| 2213 | B4 | 3132 | B6 | 3867 | C2 | 6567 | D4 |
| 2214 | B4 | 3134 | C6 | 3891 | B3 | 6569 | D4 |
| 2215 | B4 | 3151 | B6 | 3893 | C3 | 6570 | C3 |
| 2217 | A4 | 3152 | B6 | 3894 | B3 | 6580 | C2 |
| 2219 | A5 | 3153 | B6 | 3896 | C3 | 6581 | C2 |
| 2221 | B4 | 3184 | C1 | 3901 | B3 | 6601 | B4 |
| 2222 | A6 | 3186 | C1 | 3902 | B3 | 6901 | B3 |
| 2223 | A6 | 3205 | B4 | 3903 | A3 | 7001 | A5 |
| 2225 | A4 | 3206 | B4 | 3904 | A3 | 7002 | A5 |
| 2226 | A4 | 3208 | A4 | 3905 | A3 | 7101 | B6 |
| 2227 | A4 | 3209 | A4 | 3906 | A3 | 7200 | A4 |
| 2228 | A4 | 3212 | A4 | 3907 | A3 | 7201 | A4 |
| 2233 | B4 | 3214 | A4 | 3921 | A3 | 7202 | A4 |
| 2234 | A6 | 3215 | A3 | 3922 | A3 | 7203 | A4 |
| 2236 | A6 | 3217 | B4 | 3923 | A3 | 7204 | B4 |
| 2237 | A6 | 3218 | B4 | 3941 | A3 | 7205 | A4 |
| 2238 | A6 | 3219 | B4 | 3942 | A3 | 7206 | A4 |
| 2239 | A6 | 3223 | B4 | 3943 | A3 | 7208 | A4 |
| 2240 | A6 | 3224 | B4 | 3944 | A3 | 7209 | A6 |
| 2241 | A5 | 3225 | B4 | 3945 | A3 | 7210 | A6 |
| 2242 | A5 | 3226 | B4 | 3946 | A3 | 7241 | B4 |
| 2243 | A5 | 3229 | A4 | 3947 | A3 | 7401 | C4 |
| 2245 | A4 | 3230 | A4 | 3948 | A3 | 7405 | D5 |
| 2248 | A5 | 3231 | A4 | 3949 | A3 | 7406 | C5 |
| 2249 | A5 | 3232 | A4 | 3950 | A3 | 7409 | C5 |
| 2252 | A5 | 3233 | A6 | 3951 | A3 | 7522 | D3 |
| 2253 | A5 | 3234 | A4 | 4001 | A5 | 7541 | C3 |
| 2254 | A5 | 3236 | A6 | 4002 | A5 | 7542 | C3 |
| 2255 | A3 | 3237 | A6 | 4003 | A5 | 7561 | C4 |
| 2403 | C4 | 3238 | A6 | 4004 | A5 | 7562 | D4 |
| 2405 | D5 | 3239 | A6 | 4005 | A5 | 7564 | D4 |
| 2406 | C4 | 3240 | A6 | 4006 | A5 | 7580 | C2 |
| 2415 | C5 | 3241 | A5 | 4011 | A5 | 7606 | B5 |
| 2418 | C6 | 3242 | A3 | 4012 | A5 | 7861 | C2 |
| 2421 | C5 | 3245 | A5 | 4101 | B6 | 7891 | B3 |
| 2475 | D6 | 3246 | A4 | 4102 | B6 | 7892 | B3 |
| 2477 | C6 | 3247 | C5 | 4104 | B6 | 7941 | A3 |
| 2520 | D3 | 3248 | A4 | 4121 | B6 | 7942 | A3 |
| 2522 | D3 | 3254 | A5 | 4131 | C6 | 7943 | A3 |
| 2524 | D3 | 3256 | C4 | 4181 | B5 | | |
| 2525 | D3 | 3257 | A5 | 4203 | A4 | | |
| 2526 | D3 | 3258 | A5 | 4204 | A4 | | |
| 2527 | D3 | 3259 | B5 | 4205 | B4 | | |
| 2528 | D3 | 3261 | A5 | 4206 | B4 | | |
| 2540 | C4 | 3410 | D6 | 4207 | B4 | | |
| 2541 | C3 | 3413 | D5 | 4209 | A4 | | |
| 2542 | D3 | 3418 | C5 | 4210 | A4 | | |
| 2559 | C3 | 3419 | C5 | 4211 | A4 | | |
| 2569 | D4 | 3420 | C6 | 4212 | A4 | | |
| 2590 | C4 | 3422 | C5 | 4213 | A4 | | |
| 2591 | D4 | 3423 | C5 | 4214 | B3 | | |
| 2601 | B4 | 3426 | C5 | 4216 | A6 | | |
| 2602 | B4 | 3431 | D5 | 4217 | A3 | | |
| 2606 | B5 | 3520 | D3 | 4410 | C5 | | |
| 2607 | B4 | 3522 | D3 | 4411 | C4 | | |
| 2608 | B5 | 3524 | D3 | 4501 | D4 | | |
| 2609 | B4 | 3525 | D3 | 4562 | D4 | | |
| 2611 | B4 | 3528 | D3 | 4601 | B5 | | |
| 2612 | B5 | 3529 | D3 | 4602 | B5 | | |
| 2613 | B5 | 3530 | D3 | 4603 | B4 | | |
| 2615 | B4 | 3531 | D3 | 4604 | A3 | | |
| 2616 | B5 | 3540 | D4 | 4608 | A7 | | |
| 2618 | B4 | 3541 | D3 | 4609 | A7 | | |
| 2619 | B5 | 3542 | D4 | 4613 | B4 | | |
| 2692 | E1 | 3545 | D4 | 4614 | A3 | | |
| 2693 | D2 | 3546 | C3 | 4615 | B5 | | |

## Layout Mono Carrier Non DBX (Part 1 Bottom Side)



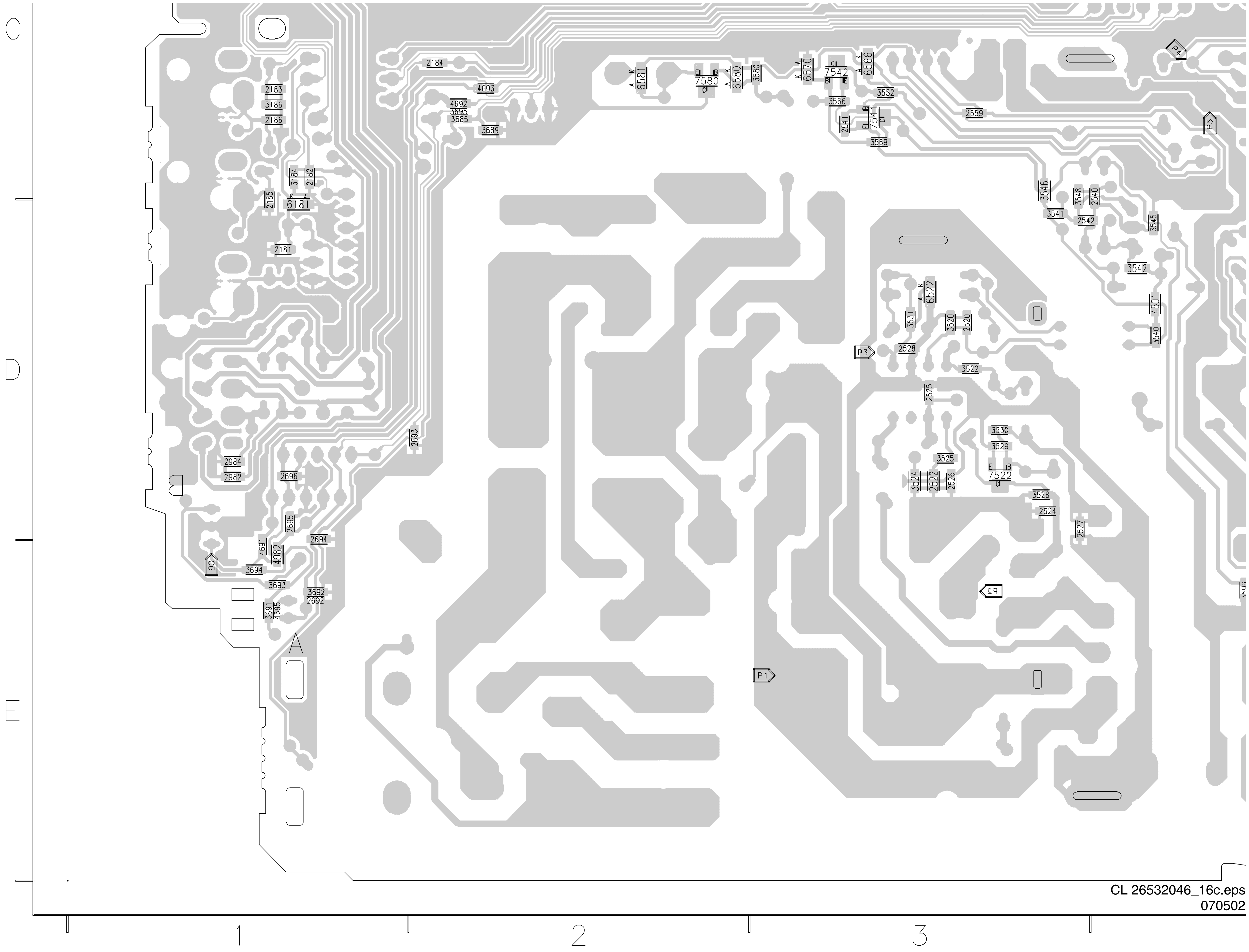
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100402

## Layout Mono Carrier Non DBX (Part 2 Bottom Side)



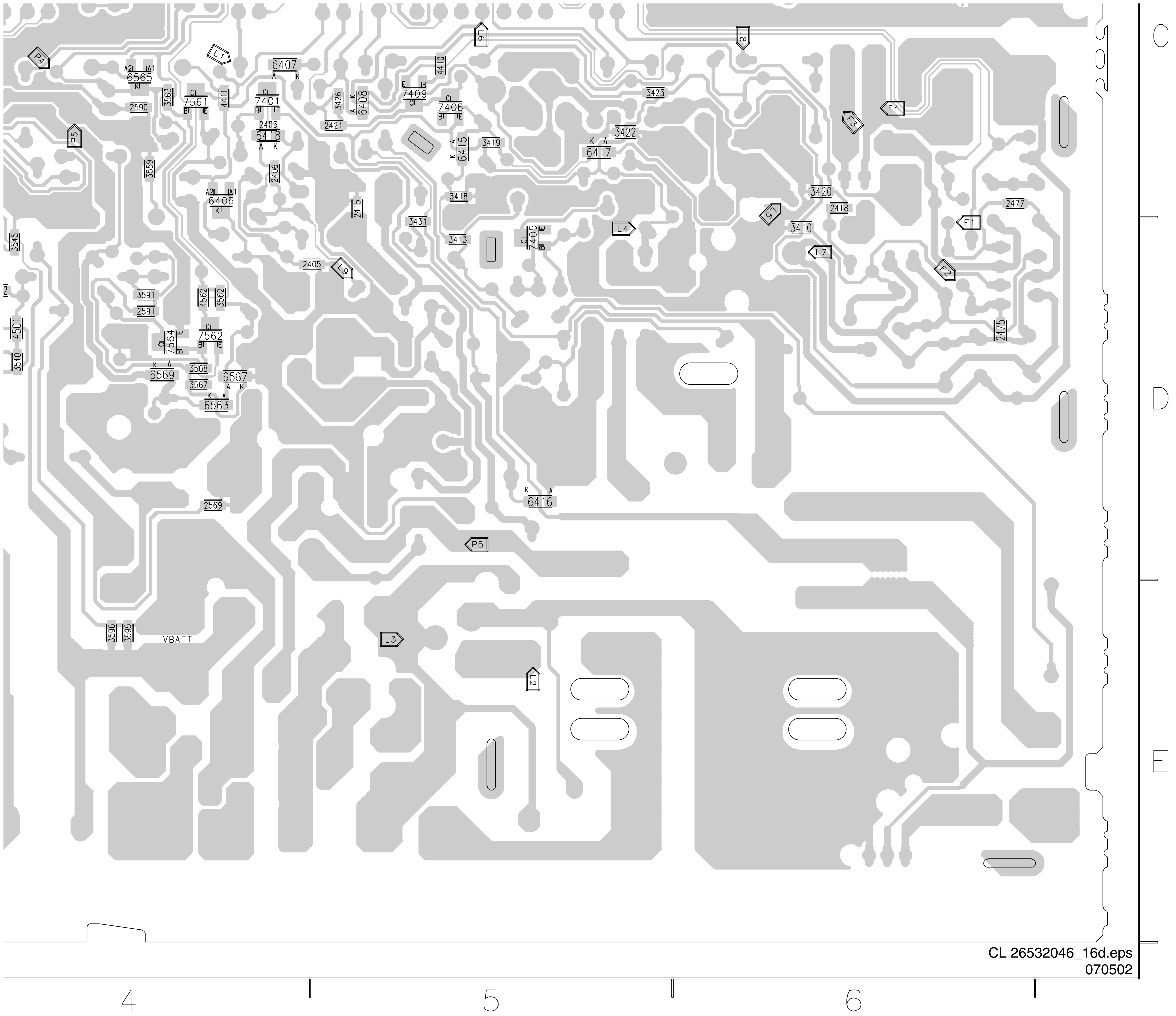

CL 26532046_16b.eps
100402

## Layout Mono Carrier Non DBX (Part 3 Bottom Side)



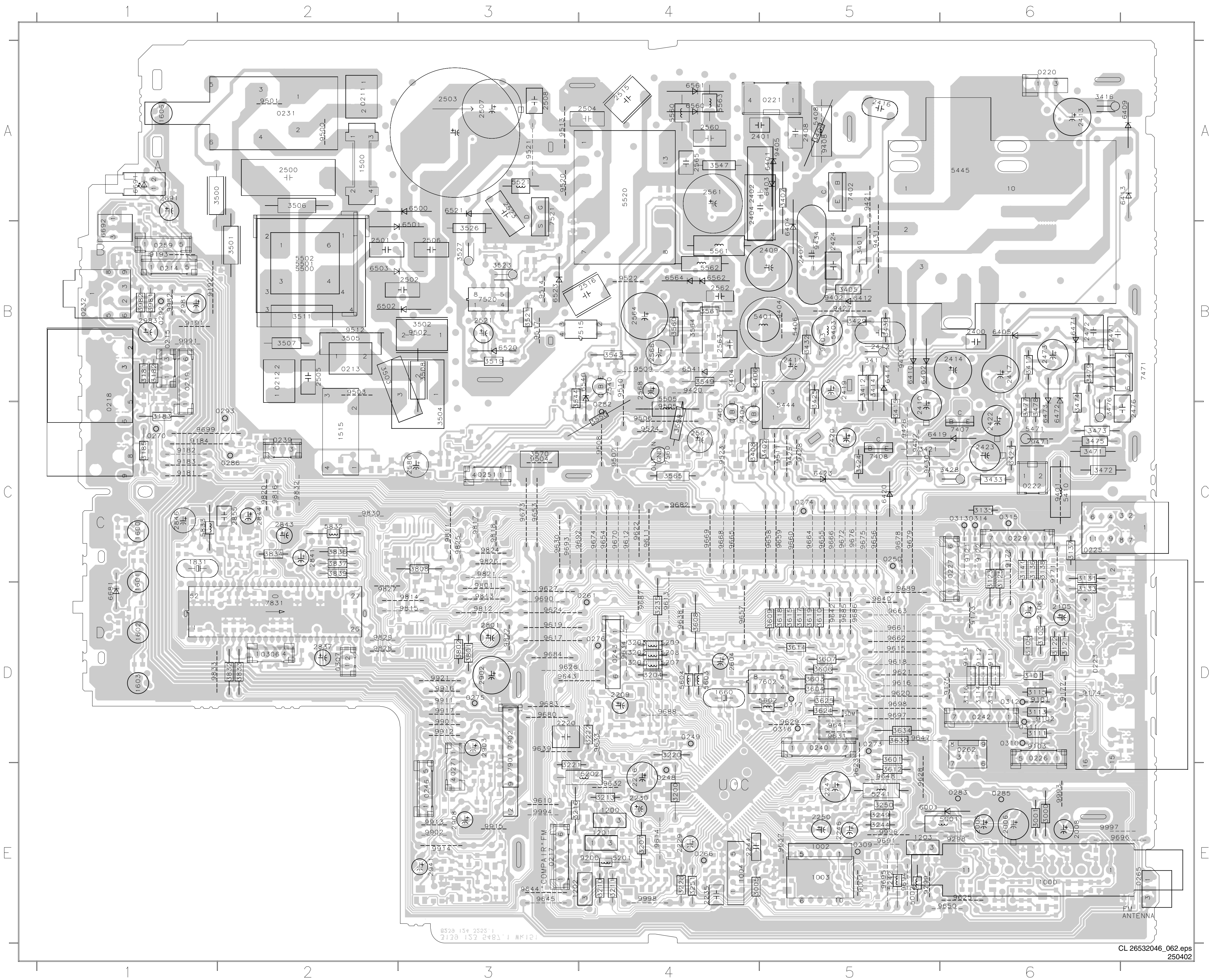

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070502

## Layout Mono Carrier Non DBX (Part 4 Bottom Side)




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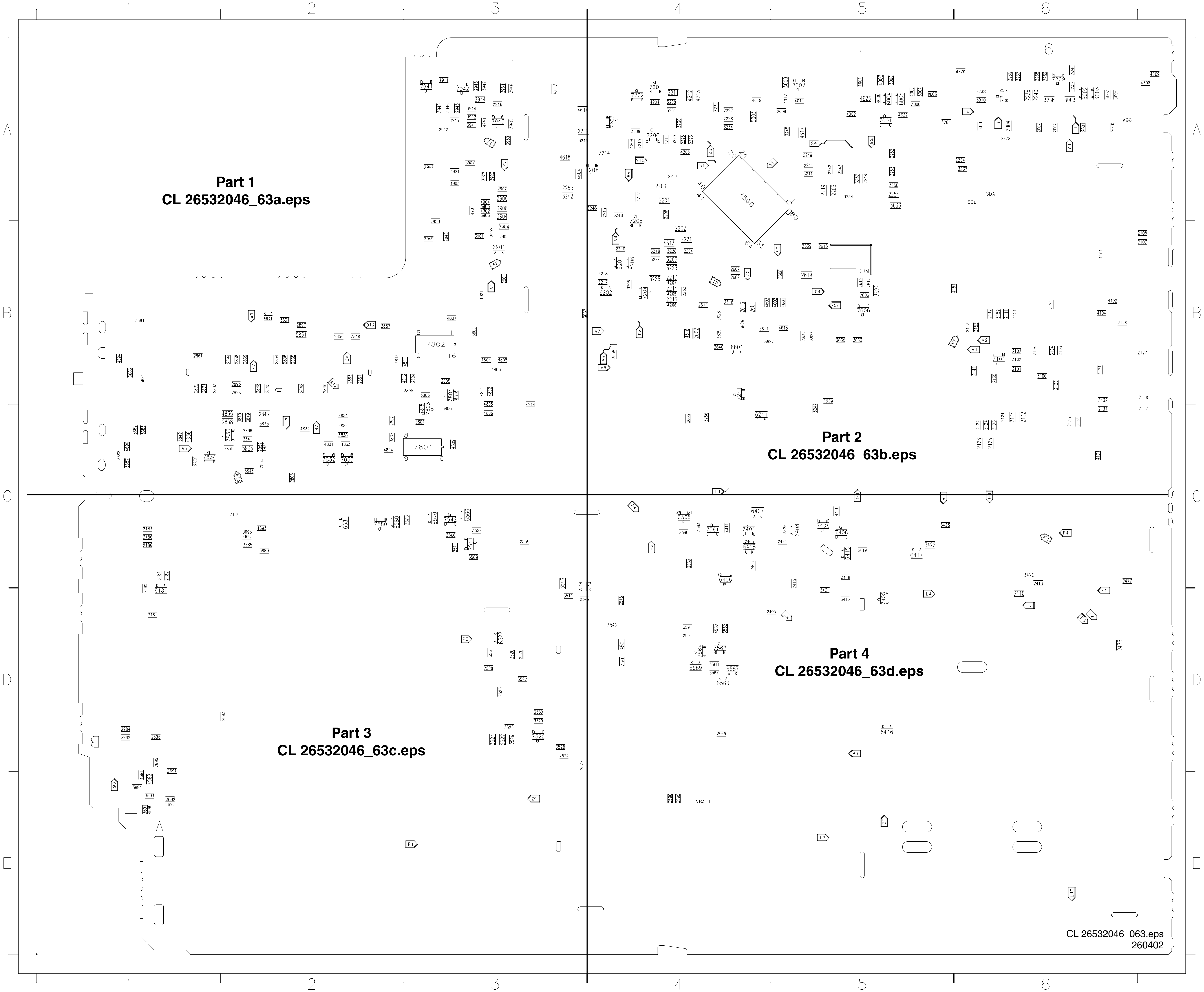
## Layout Mono Carrier DBX (Top Side)




| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 0211 | A2 | 2565 | A4 | 3608 | D4 | 9401 | C6 | 9821 | C3 |
| 0212 | B2 | 2566 | B4 | 3609 | D5 | 9402 | B5 | 9822 | D3 |
| 0213 | B2 | 2567 | C4 | 3610 | D5 | 9403 | B5 | 9824 | C3 |
| 0214 | B1 | 2568 | B4 | 3612 | E5 | 9404 | B5 | 9825 | C3 |
| 0215 | B1 | 2580 | C3 | 3614 | D5 | 9405 | A5 | 9826 | C3 |
| 0217 | E3 | 2604 | D4 | 3615 | D5 | 9408 | A5 | 9827 | D2 |
| 0218 | C1 | 2691 | A1 | 3617 | D5 | 9420 | B4 | 9828 | D2 |
| 0219 | B1 | 2801 | D3 | 3618 | D5 | 9421 | A5 | 9829 | D2 |
| 0220 | A6 | 2837 | D2 | 3619 | D5 | 9425 | C5 | 9830 | C2 |
| 0221 | A5 | 2841 | C2 | 3624 | D5 | 9426 | C5 | 9832 | C2 |
| 0222 | C6 | 2843 | C2 | 3625 | D5 | 9427 | B5 | 9833 | D1 |
| 0223 | D6 | 2844 | C2 | 3634 | D5 | 9428 | C5 | 9901 | D3 |
| 0225 | C6 | 2846 | C1 | 3635 | D5 | 9430 | C5 | 9902 | E3 |
| 0226 | D6 | 2855 | C2 | 3801 | D3 | 9431 | B5 | 9911 | D3 |
| 0227 | C6 | 2902 | D3 | 3802 | D3 | 9432 | C5 | 9912 | D3 |
| 0229 | C6 | 2903 | D3 | 3808 | C3 | 9433 | B5 | 9913 | E3 |
| 0231 | A2 | 2908 | E3 | 3832 | D2 | 9434 | B5 | 9914 | E3 |
| 0232 | B1 | 2941 | E3 | 3833 | D2 | 9471 | C6 | 9915 | E3 |
| 0239 | C2 | 2981 | B1 | 3834 | C2 | 9500 | A2 | 9916 | D3 |
| 0240 | D5 | 2983 | B1 | 3836 | C2 | 9501 | A2 | 9917 | D3 |
| 0242 | D6 | 3000 | E6 | 3837 | C2 | 9502 | B3 | 9921 | D3 |
| 0243 | D4 | 3001 | E6 | 3839 | C2 | 9503 | B2 | 9982 | B1 |
| 0246 | E3 | 3005 | E4 | 3981 | B1 | 9504 | C3 | 9991 | B1 |
| 0248 | E4 | 3101 | D6 | 3982 | B1 | 9505 | C4 | 9993 | E6 |
| 0249 | D4 | 3103 | D6 | 5001 | E6 | 9506 | C4 | 9994 | E3 |
| 0250 | C5 | 3105 | D6 | 5002 | E5 | 9507 | C4 | 9996 | E5 |
| 0251 | C3 | 3111 | D6 | 5201 | E4 | 9508 | C4 | 9997 | E6 |
| 0259 | B1 | 3112 | D6 | 5202 | E4 | 9509 | B4 | 9998 | E4 |
| 0261 | D4 | 3113 | D6 | 5207 | D4 | 9510 | B4 | | |
| 0262 | D6 | 3114 | D6 | 5208 | D4 | 9511 | C5 | | |
| 0265 | E7 | 3115 | D6 | 5209 | D4 | 9512 | B2 | | |
| 0266 | E4 | 3116 | D6 | 5241 | E5 | 9513 | A3 | | |
| 0270 | C1 | 3121 | D6 | 5242 | E5 | 9514 | B3 | | |
| 0271 | E3 | 3122 | D6 | 5401 | B5 | 9517 | B3 | | |
| 0273 | D5 | 3123 | C6 | 5403 | B5 | 9520 | A3 | | |
| 0274 | C5 | 3125 | C6 | 5406 | B5 | 9521 | A3 | | |
| 0275 | D3 | 3131 | C6 | 5408 | A5 | 9522 | B4 | | |
| 0276 | D4 | 3133 | D6 | 5410 | C6 | 9523 | C4 | | |
| 0277 | B1 | 3135 | C6 | 5444 | C5 | 9524 | C4 | | |
| 0282 | C4 | 3136 | C6 | 5445 | A6 | 9610 | E3 | | |
| 0283 | E6 | 3137 | C6 | 5471 | C6 | 9611 | C4 | | |
| 0285 | E6 | 3138 | C6 | 5500 | B2 | 9612 | C4 | | |
| 0286 | C2 | 3141 | C6 | 5501 | B2 | 9613 | D4 | | |
| 0292 | B1 | 3181 | B1 | 5502 | B2 | 9614 | E4 | | |
| 0293 | C2 | 3182 | B1 | 5505 | B4 | 9615 | D5 | | |
| 0306 | D2 | 3183 | C1 | 5520 | A4 | 9616 | D5 | | |
| 0307 | D2 | 3185 | C1 | 5521 | A3 | 9617 | D3 | | |
| 0309 | E5 | 3200 | E4 | 5560 | A4 | 9618 | D5 | | |
| 0310 | D6 | 3201 | D4 | 5561 | B4 | 9619 | D3 | | |
| 0311 | D6 | 3202 | D4 | 5562 | B4 | 9620 | D5 | | |
| 0312 | D6 | 3203 | D4 | 5563 | A4 | 9621 | D5 | | |
| 0313 | C6 | 3204 | D4 | 5602 | D5 | 9622 | C4 | | |
| 0314 | C6 | 3207 | E4 | 5603 | D4 | 9623 | E5 | | |
| 0315 | C6 | 3210 | E4 | 5604 | D4 | 9624 | D3 | | |
| 0316 | D5 | 3211 | E4 | 5832 | C2 | 9625 | E6 | | |
| 0317 | D5 | 3213 | E4 | 5833 | C1 | 9626 | D3 | | |
| 1000 | E6 | 3216 | E3 | 6001 | E5 | 9627 | D3 | | |
| 1002 | E5 | 3220 | D4 | 6401 | A5 | 9628 | E5 | | |
| 1003 | E5 | 3221 | E3 | 6402 | B5 | 9629 | D5 | | |
| 1004 | E4 | 3222 | D4 | 6403 | A5 | 9630 | C3 | | |
| 1200 | E4 | 3228 | E4 | 6404 | B5 | 9631 | D5 | | |
| 1201 | E4 | 3235 | D4 | 6405 | B6 | 9632 | E4 | | |
| 1202 | E3 | 3244 | E5 | 6409 | A7 | 9633 | D4 | | |
| 1203 | E5 | 3249 | E5 | 6410 | B5 | 9634 | D4 | | |
| 1500 | A2 | 3250 | E5 | 6412 | B5 | 9637 | E5 | | |
| 1515 | C2 | 3251 | E4 | 6413 | A7 | 9638 | D4 | | |
| 1600 | C1 | 3401 | B5 | 6414 | B5 | 9639 | D3 | | |
| 1601 | D1 | 3402 | C5 | 6419 | C5 | 9640 | D5 | | |
| 1602 | D1 | 3403 | A5 | 6420 | C5 | 9641 | D5 | | |
| 1603 | D1 | 3404 | B4 | 6423 | C5 | 9642 | D5 | | |
| 1606 | A1 | 3405 | B5 | 6471 | B6 | 9643 | D3 | | |
| 1660 | D4 | 3406 | B4 | 6472 | C6 | 9644 | E3 | | |
| 1831 | C1 | 3407 | A5 | 6473 | C6 | 9645 | E3 | | |
| 2005 | E6 | 3408 | C4 | 6500 | A3 | 9647 | D5 | | |
| 2006 | E6 | 3411 | B5 | 6501 | B3 | 9648 | E5 | | |
| 2008 | E6 | 3412 | B5 | 6502 | B2 | 9650 | E6 | | |
| 2105 | D6 | 3414 | B5 | 6503 | B2 | 9653 | C3 | | |
| 2106 | D6 | 3415 | C5 | 6520 | B3 | 9654 | C4 | | |
| 2209 | D4 | 3416 | A6 | 6521 | A3 | 9655 | C5 | | |
| 2216 | E4 | 3417 | B6 | 6523 | B3 | 9656 | C5 | | |
| 2220 | D3 | 3421 | C5 | 6540 | B4 | 9657 | D4 | | |
| 2229 | E4 | 3424 | C5 | 6541 | B4 | 9658 | C5 | | |
| 2230 | E4 | 3425 | B5 | 6560 | A4 | 9659 | C5 | | |
| 2235 | E4 | 3427 | C6 | 6561 | A4 | 9660 | C5 | | |
| 2244 | E4 | 3428 | C6 | 6562 | B4 | 9661 | D5 | | |
| 2246 | E5 | 3429 | B5 | 6564 | B4 | 9662 | D5 | | |
| 2247 | E5 | 3430 | B5 | 6681 | D1 | 9663 | D5 | | |
| 2250 | E5 | 3432 | B5 | 6691 | A1 | 9664 | C5 | | |
| 2400 | B6 | 3433 | C6 | 6692 | B1 | 9665 | C4 | | |
| 2401 | A5 | 3471 | C6 | 6402 | A5 | 9666 | C5 | | |
| 2402 | A4 | 3472 | C6 | 6403 | C4 | 9668 | C4 | | |
| 2404 | A4 | 3473 | C6 | 6404 | C4 | 9669 | C4 | | |
| 2407 | B5 | 3474 | C6 | 6407 | C6 | 9670 | C4 | | |
| 2408 | A5 | 3475 | C6 | 6408 | C5 | 9672 | C5 | | |
| 2409 | B5 | 3476 | C6 | 6471 | B7 | 9673 | C3 | | |
| 2410 | C5 | 3477 | C6 | 6515 | B4 | 9674 | C4 | | |
| 2411 | B5 | 3478 | C6 | 6520 | B3 | 9675 | C5 | | |
| 2412 | B5 | 3479 | B6 | 6521 | A3 | 9676 | C5 | | |
| 2413 | A6 | 3500 | A1 | 6540 | B4 | 9678 | C5 | | |
| 2414 | B6 | 3501 | B2 | 6560 | C4 | 9679 | C5 | | |
| 2416 | A5 | 3502 | B3 | 6602 | D5 | 9680 | D3 | | |
| 2417 | B6 | 3503 | B2 | 6831 | D2 | 9682 | C4 | | |
| 2419 | B5 | 3504 | C3 | 6901 | D3 | 9683 | D3 | | |
| 2420 | C5 | 3505 | B2 | 6902 | D3 | 9684 | D3 | | |
| 2422 | C6 | 3506 | A2 | 9001 | E5 | 9685 | D5 | | |
| 2423 | C6 | 3507 | B2 | 9101 | D6 | 9686 | D5 | | |
| 2424 | B5 | 3508 | B3 | 9102 | D6 | 9687 | D4 | | |
| 2471 | B6 | 3511 | B2 | 9103 | D6 | 9688 | D4 | | |
| 2472 | B6 | 3519 | B3 | 9111 | D6 | 9689 | D5 | | |
| 2473 | B6 | 3521 | B3 | 9112 | D6 | 9690 | D3 | | |
| 2476 | C7 | 3523 | B3 | 9113 | D6 | 9691 | E5 | | |
| 2500 | A2 | 3526 | B3 | 9121 | C6 | 9692 | C3 | | |
| 2501 | B2 | 3527 | B3 | 9122 | C6 | 9693 | C3 | | |
| 2502 | B3 | 3543 | B4 | 9171 | C6 | 9694 | E5 | | |
| 2503 | A3 | 3544 | B3 | 9172 | C6 | 9695 | E5 | | |
| 2504 | A4 | 3547 | A4 | 9173 | D6 | 9696 | E6 | | |
| 2505 | B2 | 3549 | B4 | 9174 | D6 | 9697 | D5 | | |
| 2506 | B3 | 3550 | C4 | 9175 | D6 | 9698 | D5 | | |
| 2507 | A3 | 3558 | C4 | 9177 | D6 | 9699 | C1 | | |
| 2508 | A3 | 3560 | B4 | 9181 | C1 | 9801 | D3 | | |
| 2515 | A4 | 3561 | B4 | 9182 | C1 | 9811 | C3 | | |
| 2516 | B4 | 3564 | B4 | 9183 | C1 | 9812 | D3 | | |
| 2521 | B3 | 3565 | C4 | 9184 | C1 | 9813 | D3 | | |
| 2523 | A3 | 3570 | C3 | 9191 | B1 | 9814 | D3 | | |
| 2560 | A4 | 3601 | D5 | 9192 | B1 | 9815 | D3 | | |
| 2561 | A4 | 3603 | D5 | 9193 | B1 | 9816 | C2 | | |
| 2562 | B4 | 3604 | D5 | 9200 | E4 | 9817 | C3 | | |
| 2563 | B4 | 3606 | D5 | 9298 | E6 | 9818 | C3 | | |
| 2564 | B4 | 3607 | D5 | 9299 | E5 | 9820 | C2 | | |

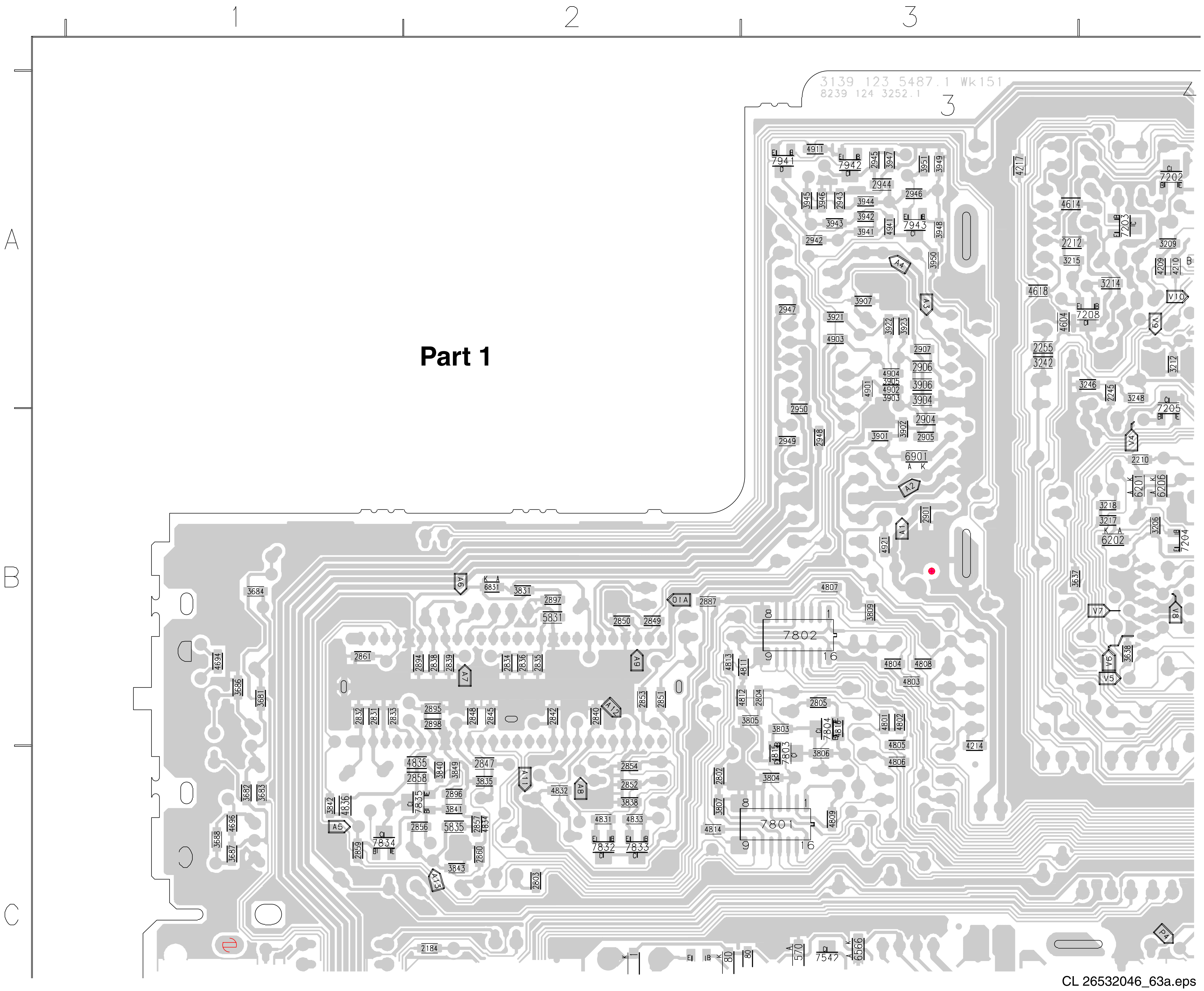
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## Layout Mono Carrier DBX (Overview Bottom Side)



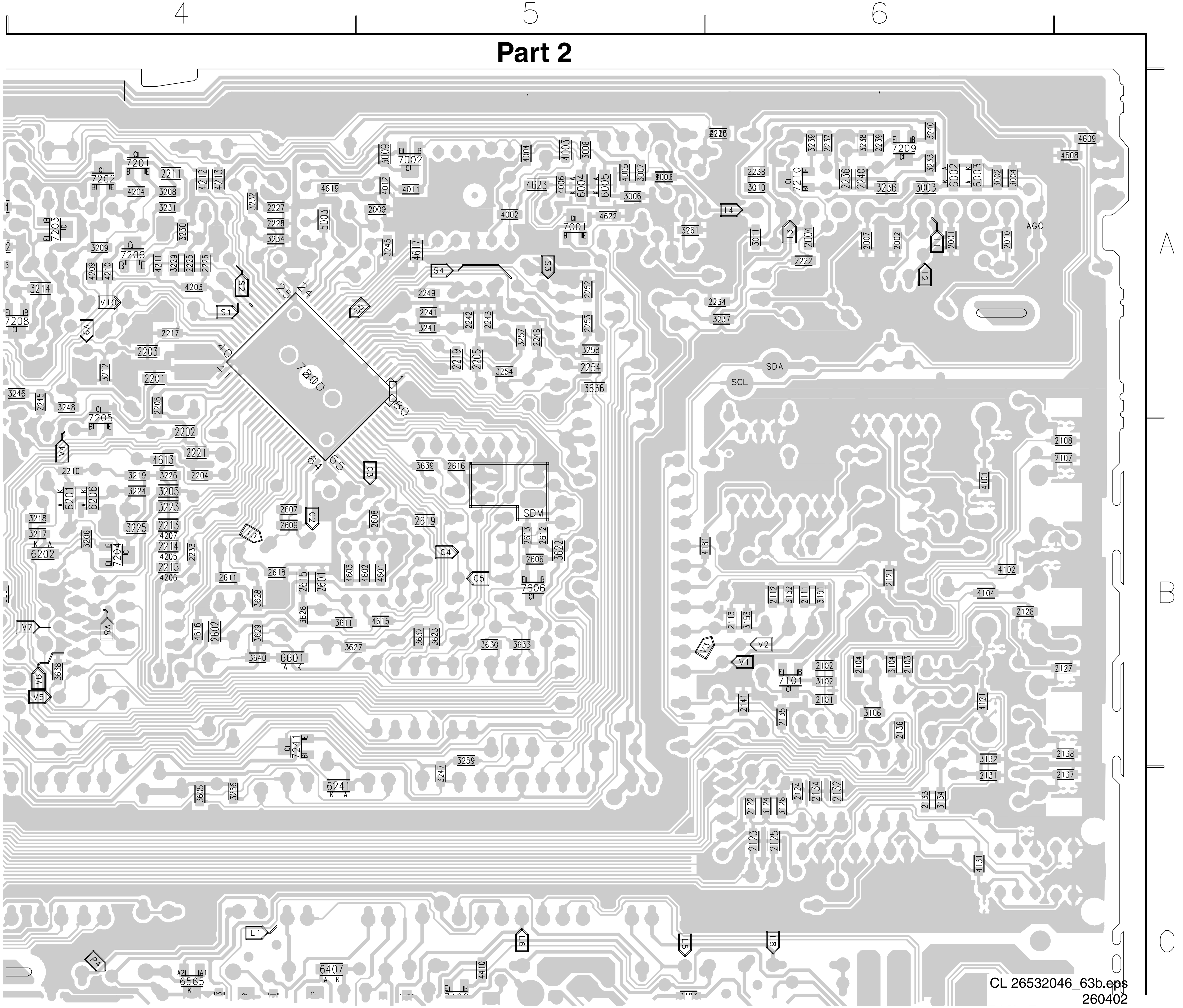

| | | | | | |
|---|---|---|---|---|---|
| F001 | A6 | I002 | A6 | I507 | D3 |
| F002 | B5 | I003 | A5 | I508 | D3 |
| F003 | A6 | I005 | A6 | I509 | D3 |
| F004 | A5 | I006 | A5 | I510 | D3 |
| F005 | A6 | I007 | B5 | I511 | D3 |
| F006 | A5 | I008 | A5 | I512 | D3 |
| F007 | A6 | I009 | A5 | I513 | D3 |
| F008 | A6 | I010 | A5 | I514 | E3 |
| F009 | A5 | I011 | A6 | I515 | D3 |
| F010 | A6 | I013 | A4 | I516 | C3 |
| F101 | B6 | I014 | A4 | I517 | D4 |
| F102 | B6 | I016 | A6 | I518 | D4 |
| F103 | A6 | I018 | A4 | I519 | D4 |
| F104 | B6 | I101 | B6 | I520 | D4 |
| F105 | B6 | I102 | B6 | I521 | D4 |
| F106 | B7 | I103 | C5 | I522 | D4 |
| F107 | B6 | I104 | B6 | I523 | C3 |
| F108 | B6 | I105 | B6 | I525 | C4 |
| F109 | B7 | I106 | B6 | I526 | D4 |
| F110 | C6 | I107 | B6 | I527 | D3 |
| F111 | B6 | I108 | B6 | I528 | E2 |
| F112 | C6 | I109 | B6 | I529 | E2 |
| F113 | C6 | I110 | B6 | I530 | C2 |
| F114 | C6 | I111 | C6 | I531 | D3 |
| F115 | C5 | I112 | C6 | I532 | D3 |
| F116 | A6 | I113 | B6 | I533 | E3 |
| F117 | B5 | I114 | C6 | I534 | D4 |
| F181 | D1 | I115 | B6 | I535 | D4 |
| F182 | D1 | I116 | B6 | I536 | E3 |
| F183 | C1 | I117 | B6 | I537 | E4 |
| F201 | B4 | I122 | B6 | I538 | E4 |
| F202 | B4 | I181 | D1 | I539 | E4 |
| F203 | B4 | I182 | C2 | I540 | D4 |
| F204 | B3 | I183 | D1 | I541 | E4 |
| F205 | A4 | I185 | C1 | I543 | C4 |
| F206 | B4 | I201 | B4 | I544 | D4 |
| F207 | A4 | I202 | B3 | I545 | D4 |
| F208 | B4 | I203 | A3 | I546 | D3 |
| F209 | A6 | I204 | A4 | I547 | E2 |
| F241 | B3 | I205 | A4 | I548 | C3 |
| F401 | E4 | I206 | B4 | I549 | D4 |
| F402 | E4 | I207 | A4 | I550 | D4 |
| F403 | E5 | I208 | A4 | I601 | B5 |
| F404 | E5 | I209 | B4 | I602 | B5 |
| F405 | D5 | I210 | A4 | I603 | B5 |
| F406 | D5 | I211 | A4 | I604 | B5 |
| F407 | D5 | I213 | B4 | I605 | B5 |
| F408 | D4 | I214 | B4 | I606 | B5 |
| F409 | C4 | I215 | B4 | I607 | B5 |
| F410 | D5 | I216 | B4 | I608 | B5 |
| F411 | D5 | I217 | B4 | I609 | B4 |
| F412 | D6 | I218 | A4 | I610 | A4 |
| F413 | C5 | I219 | A5 | I612 | B5 |
| F414 | D6 | I220 | A5 | I613 | B5 |
| F415 | D5 | I221 | B4 | I614 | B4 |
| F416 | C6 | I222 | A4 | I615 | A5 |
| F417 | D5 | I223 | A4 | I616 | B5 |
| F418 | C4 | I224 | A6 | I617 | A5 |
| F419 | D6 | I225 | A6 | I681 | E1 |
| F471 | D6 | I226 | A6 | I682 | B1 |
| F472 | D6 | I227 | A6 | I683 | B1 |
| F473 | D6 | I228 | A6 | I684 | C1 |
| F474 | C6 | I229 | B4 | I685 | B1 |
| F475 | C6 | I231 | A4 | I686 | C1 |
| F476 | C6 | I232 | A4 | I687 | C1 |
| F477 | C6 | I233 | A4 | I691 | E1 |
| F478 | C6 | I234 | A4 | I693 | D1 |
| F479 | D6 | I235 | A5 | I801 | C2 |
| F501 | D2 | I236 | A5 | I803 | C3 |
| F502 | D2 | I241 | A5 | I804 | C3 |
| F503 | E2 | I242 | B5 | I805 | C2 |
| F504 | E2 | I243 | A5 | I806 | C3 |
| F505 | E2 | I244 | A4 | I807 | C3 |
| F506 | E2 | I245 | A5 | I808 | C3 |
| F507 | E3 | I246 | A5 | I809 | C3 |
| F508 | E3 | I247 | A5 | I810 | C3 |
| F509 | D3 | I248 | A5 | I811 | C3 |
| F510 | D3 | I249 | A5 | I814 | B3 |
| F511 | C4 | I250 | A5 | I815 | C3 |
| F512 | D4 | I251 | B3 | I816 | B3 |
| F513 | E4 | I252 | A5 | I831 | B2 |
| F514 | E3 | I253 | A5 | I832 | B2 |
| F515 | E4 | I254 | A5 | I833 | B2 |
| F516 | E4 | I401 | E5 | I834 | B2 |
| F517 | C3 | I402 | D5 | I835 | C2 |
| F518 | C4 | I403 | D5 | I836 | B2 |
| F519 | D4 | I404 | D4 | I837 | C2 |
| F520 | D5 | I405 | E5 | I838 | B2 |
| F521 | C4 | I406 | D5 | I839 | C2 |
| F522 | C4 | I407 | D5 | I840 | B2 |
| F523 | C4 | I408 | D5 | I841 | B2 |
| F524 | C2 | I411 | C5 | I842 | C2 |
| F525 | C3 | I412 | C5 | I843 | C2 |
| F526 | D4 | I413 | D6 | I844 | B2 |
| F602 | B4 | I414 | D6 | I845 | C2 |
| F603 | B4 | I415 | D6 | I847 | C2 |
| F604 | B4 | I424 | E5 | I848 | C1 |
| F605 | B5 | I425 | E5 | I850 | C1 |
| F606 | C4 | I430 | D5 | I851 | B2 |
| F607 | B5 | I431 | E6 | I852 | B2 |
| F608 | B4 | I432 | D6 | I853 | B2 |
| F609 | A5 | I433 | E7 | I854 | C1 |
| F610 | A6 | I434 | E7 | I855 | C2 |
| F611 | A6 | I435 | D6 | I901 | B3 |
| F612 | B4 | I440 | D5 | I903 | B3 |
| F613 | B3 | I444 | D4 | I904 | B3 |
| F614 | B5 | I445 | C4 | I905 | B3 |
| F682 | D1 | I446 | D4 | I906 | A3 |
| F683 | C1 | I447 | E6 | I907 | A3 |
| F684 | C2 | I448 | C5 | I908 | A3 |
| F691 | D1 | I449 | C5 | I909 | A3 |
| F692 | D1 | I450 | C5 | I910 | B3 |
| F693 | E1 | I451 | C5 | I911 | A3 |
| F694 | B1 | I452 | D5 | I941 | A3 |
| F695 | B1 | I453 | D5 | I942 | A3 |
| F696 | C2 | I454 | C6 | I943 | A3 |
| F801 | B2 | I455 | C5 | I944 | A3 |
| F802 | B2 | I456 | C5 | I945 | A3 |
| F803 | C2 | I457 | C5 | I946 | A3 |
| F805 | C2 | I459 | C6 | I947 | A3 |
| F831 | B1 | I472 | D6 | I948 | A3 |
| F832 | B2 | I473 | D6 | I949 | A3 |
| F901 | A3 | I474 | C6 | I981 | D1 |
| F902 | A3 | I475 | C6 | I982 | D1 |
| F903 | B3 | I476 | D6 | I983 | D1 |
| F904 | A3 | I477 | D6 | I984 | D1 |
| F905 | B3 | I501 | E2 | I985 | D1 |
| F906 | B3 | I502 | E2 | I986 | D1 |
| F907 | A3 | I503 | D2 | | |
| F908 | A3 | I504 | D2 | | |
| F909 | B3 | I505 | D3 | | |
| I001 | A6 | I506 | D3 | | |

## Layout Mono Carrier DBX (Part 1 Bottom Side)

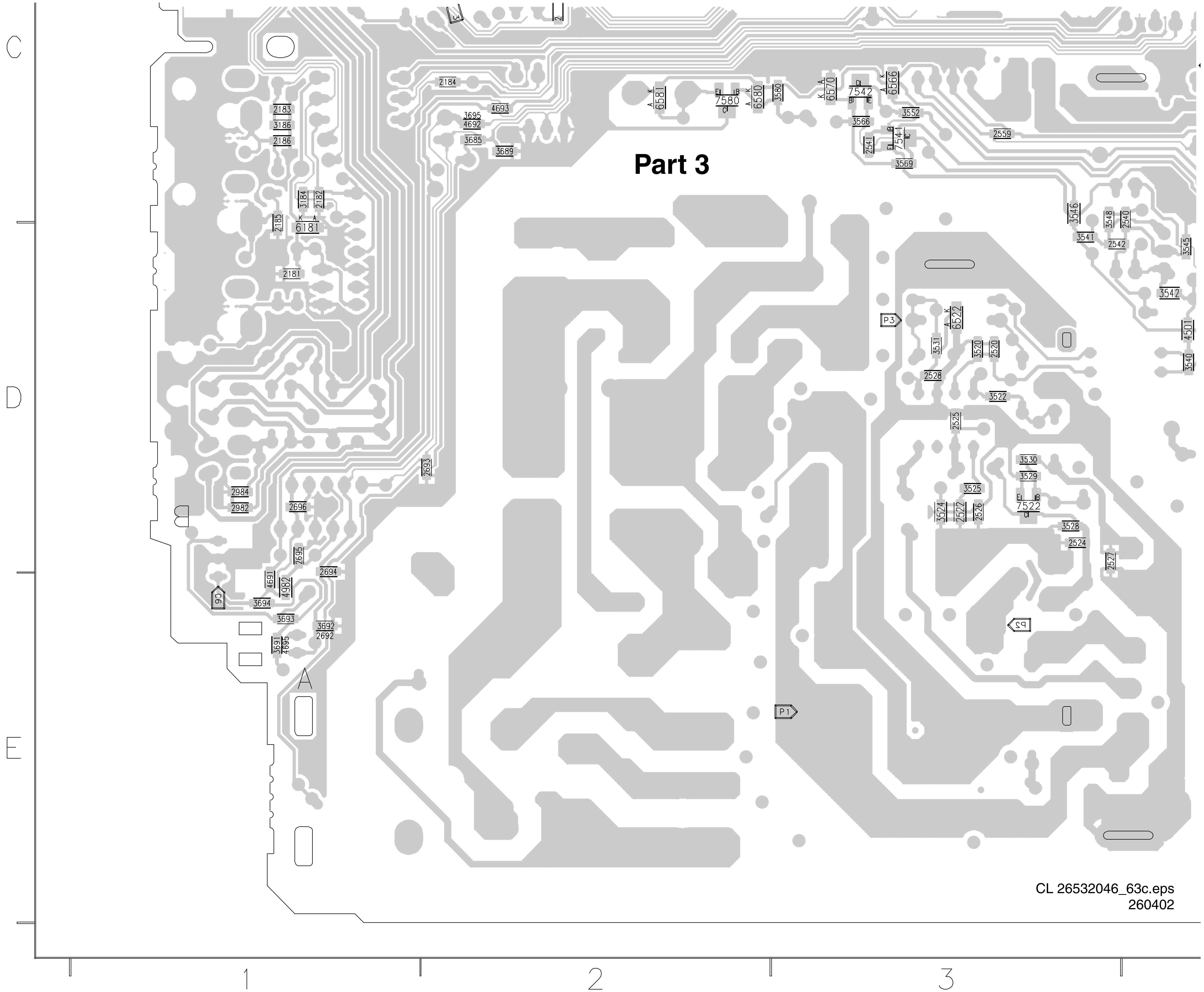



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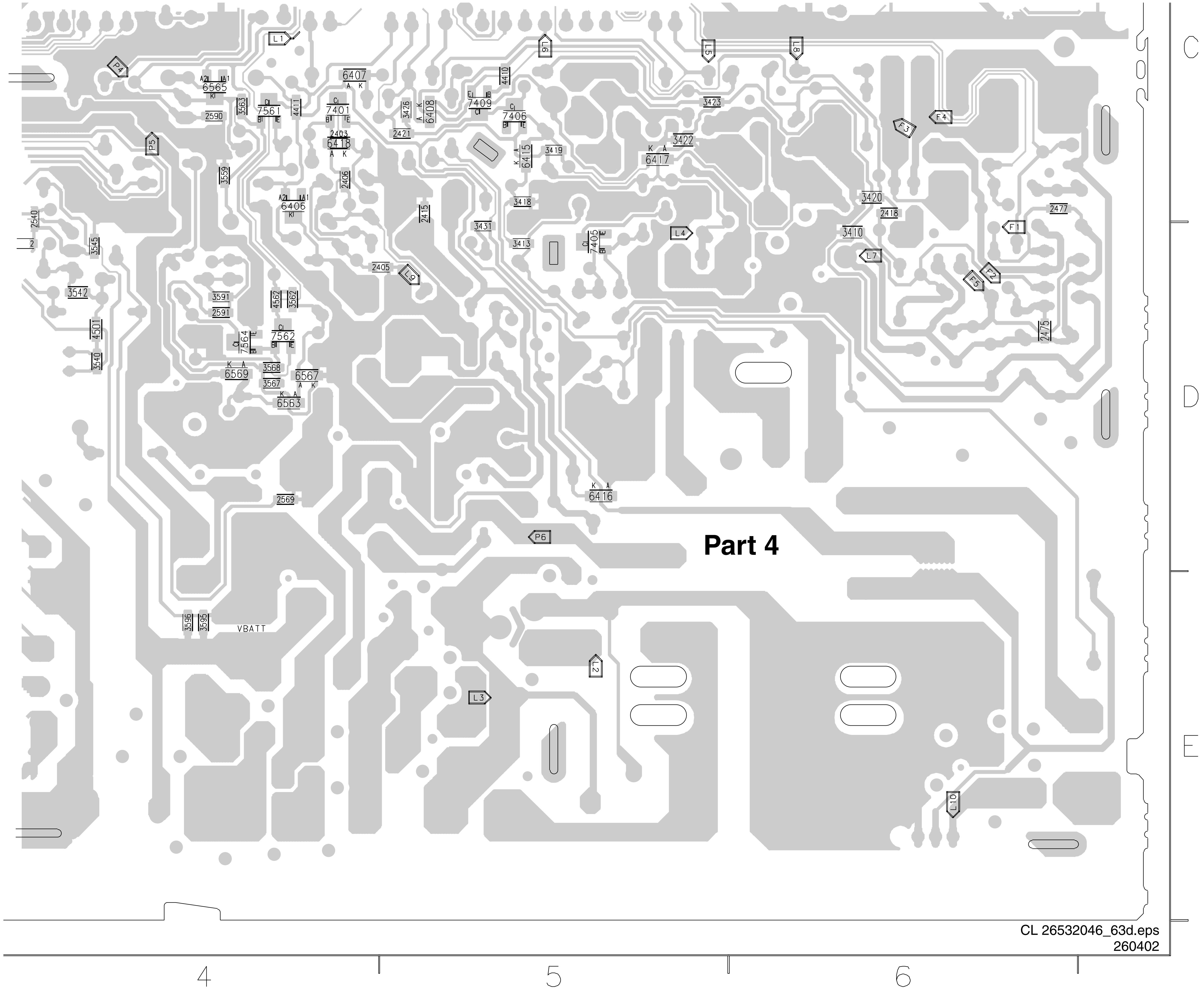
## Layout Mono Carrier DBX (Part 2 Bottom Side)



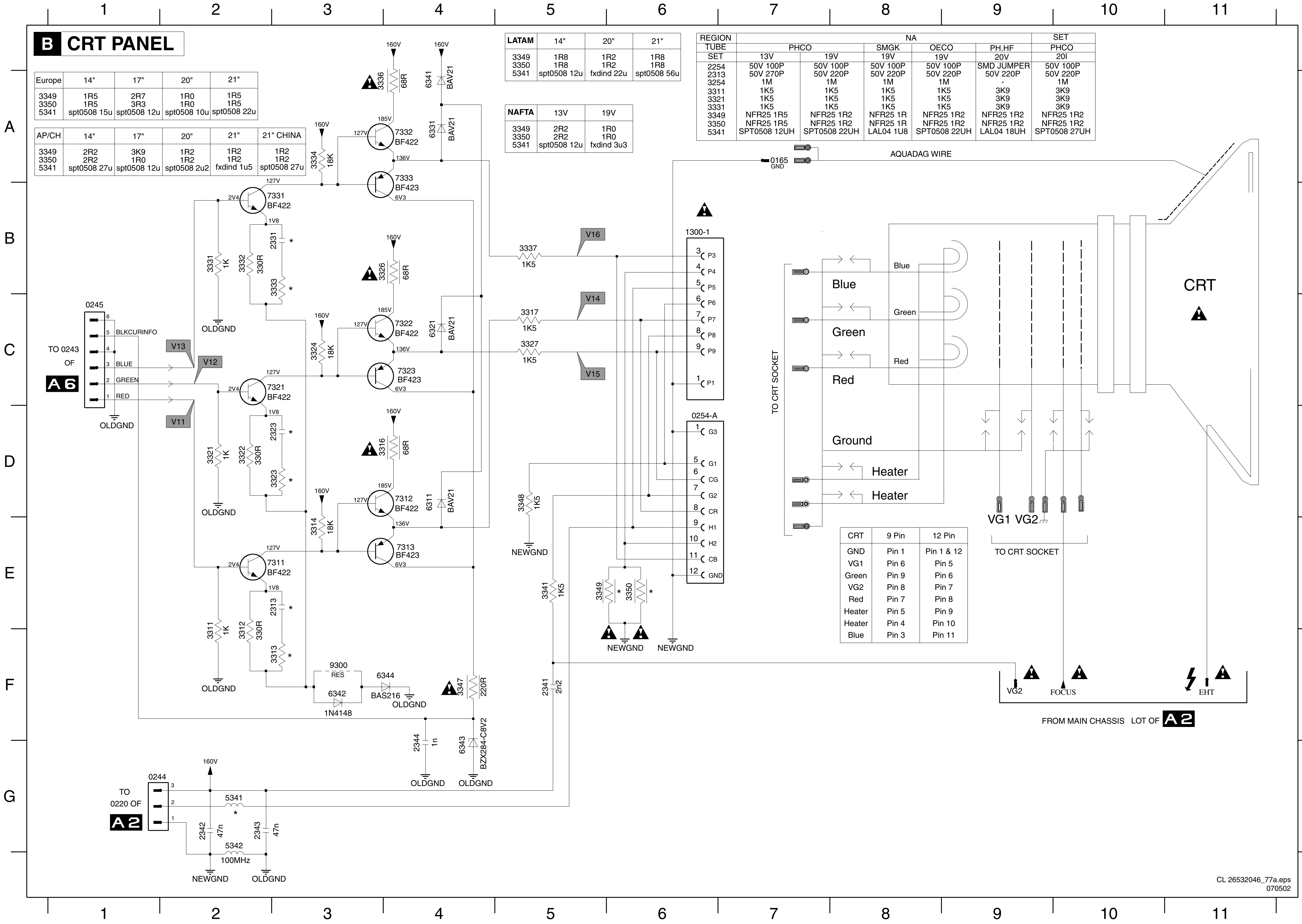
## Layout Mono Carrier DBX (Part 3 Bottom Side)



## Layout Mono Carrier DBX (Part 4 Bottom Side)



## CRT Panel




| Europe | 14" | 17" | 20" | 21" |
|---|---|---|---|---|
| 3349 | 1R5 | 2R7 | 1R0 | 1R5 |
| 3350 | 1R5 | 3R3 | 1R0 | 1R5 |
| 5341 | spt0508 15u | spt0508 12u | spt0508 10u | spt0508 22u |

| AP/CH | 14" | 17" | 20" | 21" | 21" CHINA |
|---|---|---|---|---|---|
| 3349 | 2R2 | 3K9 | 1R2 | 1R2 | 1R2 |
| 3350 | 2R2 | 1R0 | 1R2 | 1R2 | 1R2 |
| 5341 | spt0508 27u | spt0508 12u | spt0508 2u2 | fxdind 1u5 | spt0508 27u |

| **LATAM** | 14" | 20" | 21" |
|---|---|---|---|
| 3349 | 1R8 | 1R2 | 1R8 |
| 3350 | 1R8 | 1R2 | 1R8 |
| 5341 | spt0508 12u | fxdind 22u | spt0508 56u |

| **NAFTA** | 13V | 19V |
|---|---|---|
| 3349 | 2R2 | 1R0 |
| 3350 | 2R2 | 1R0 |
| 5341 | spt0508 12u | fxdind 3u3 |

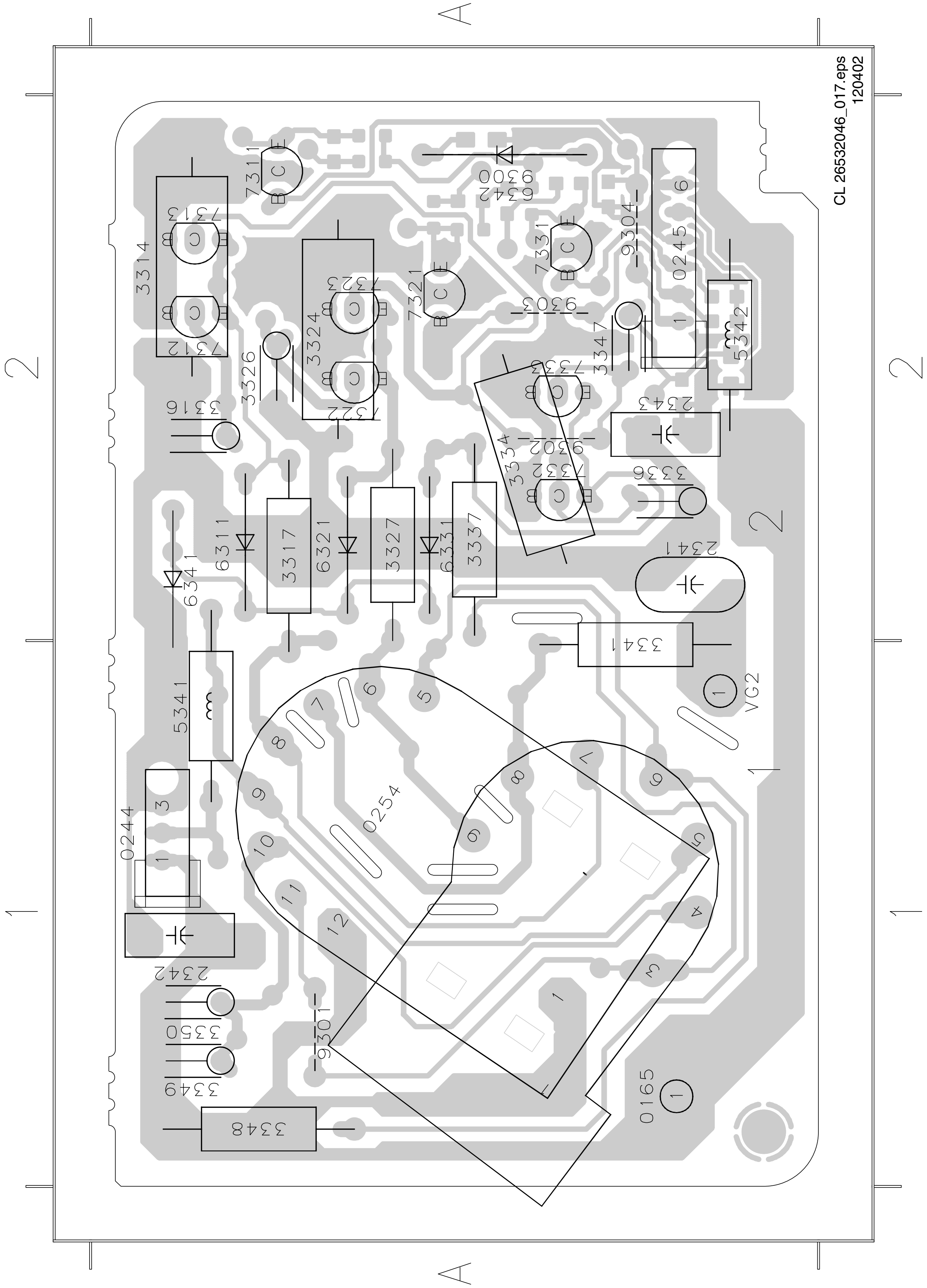
| REGION | NA | | | | | SET |
|---|---|---|---|---|---|---|
| TUBE | PHCO | | SMGK | OECO | PH.HF | PHCO |
| SET | 13V | 19V | 19V | 19V | 20V | 20I |
| 2254 | 50V 100P | 50V 100P | 50V 100P | 50V 100P | SMD JUMPER | 50V 100P |
| 2313 | 50V 270P | 50V 220P | 50V 220P | 50V 220P | 50V 220P | 50V 220P |
| 3254 | 1M | 1M | 1M | 1M | - | 1M |
| 3311 | 1K5 | 1K5 | 1K5 | 1K5 | 3K9 | 3K9 |
| 3321 | 1K5 | 1K5 | 1K5 | 1K5 | 3K9 | 3K9 |
| 3331 | 1K5 | 1K5 | 1K5 | 1K5 | 3K9 | 3K9 |
| 3349 | NFR25 1R5 | NFR25 1R2 | NFR25 1R | NFR25 1R2 | NFR25 1R2 | NFR25 1R2 |
| 3350 | NFR25 1R5 | NFR25 1R2 | NFR25 1R | NFR25 1R2 | NFR25 1R2 | NFR25 1R2 |
| 5341 | SPT0508 12UH | SPT0508 22UH | LAL04 1U8 | SPT0508 22UH | LAL04 18UH | SPT0508 27UH |

| CRT | 9 Pin | 12 Pin |
|---|---|---|
| GND | Pin 1 | Pin 1 & 12 |
| VG1 | Pin 6 | Pin 5 |
| Green | Pin 9 | Pin 6 |
| VG2 | Pin 8 | Pin 7 |
| Red | Pin 7 | Pin 8 |
| Heater | Pin 5 | Pin 9 |
| Heater | Pin 4 | Pin 10 |
| Blue | Pin 3 | Pin 11 |

VG2 F9
0165 A7
0244 G2
0245 C1
0254-A D6
1300-1 B6
2313 E3
2323 D3
2331 B3
2341 F5
2342 G2
2343 G2
2344 G4
3311 F2
3312 F2
3313 F3
3314 E3
3316 D4
3317 C5
3321 D2
3322 D2
3323 D3
3324 C3
3326 B4
3327 C5
3331 B2
3332 B2
3333 B3
3334 A3
3336 A3
3337 B5
3341 E5
3347 F4
3348 D5
3349 E5
3350 E6
5341 G2
5342 G2
6311 D4
6321 C4
6331 A4
6341 A4
6342 F3
6343 G4
6344 F4
7311 E2
7312 D4
7313 E4
7321 C2
7322 C4
7323 C4
7331 B2
7332 A4
7333 A4
9300 F3

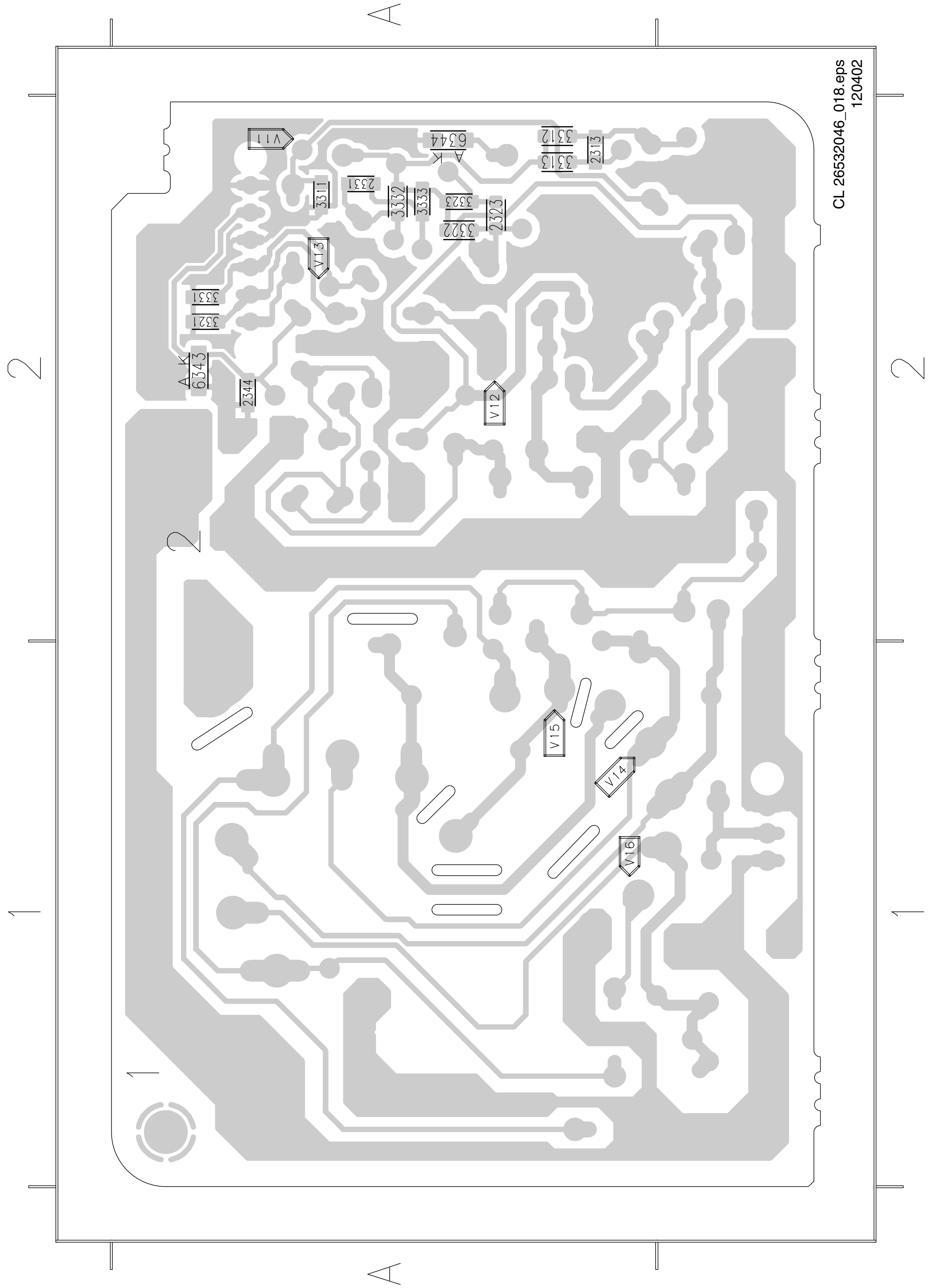
## Layout CRT Panel (Top Side)

| | |
|---|---|
| VG2 | A1 |
| 0165 | A1 |
| 0244 | A1 |
| 0245 | A2 |
| 0254 | A1 |
| 1300 | A1 |
| 2341 | A2 |
| 2342 | A1 |
| 2343 | A2 |
| 3314 | A2 |
| 3316 | A2 |
| 3317 | A2 |
| 3324 | A2 |
| 3326 | A2 |
| 3327 | A2 |
| 3334 | A2 |
| 3336 | A2 |
| 3337 | A2 |
| 3341 | A1 |
| 3347 | A2 |
| 3348 | A1 |
| 3349 | A1 |
| 3350 | A1 |
| 5341 | A1 |
| 5342 | A2 |
| 6311 | A2 |
| 6321 | A2 |
| 6331 | A2 |
| 6341 | A2 |
| 6342 | A2 |
| 7311 | A2 |
| 7312 | A2 |
| 7313 | A2 |
| 7321 | A2 |
| 7322 | A2 |
| 7323 | A2 |
| 7331 | A2 |
| 7332 | A2 |
| 7333 | A2 |
| 9300 | A2 |
| 9301 | A1 |
| 9302 | A2 |
| 9303 | A2 |
| 9304 | A2 |

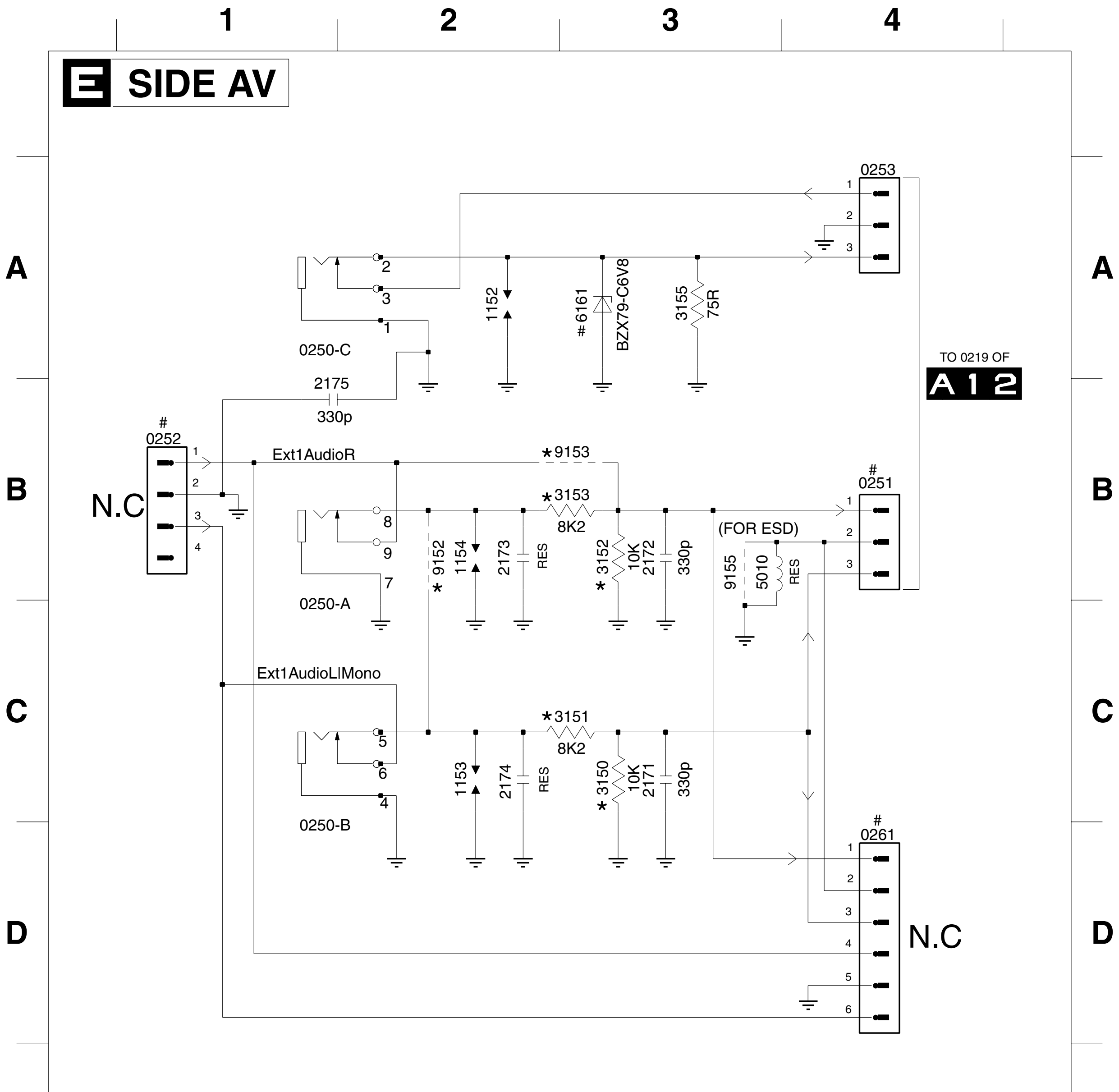



## Layout CRT Panel (Bottom Side)

| | |
|---|---|
| 2313 | A2 |
| 2323 | A2 |
| 2331 | A2 |
| 2344 | A2 |
| 3311 | A2 |
| 3312 | A2 |
| 3313 | A2 |
| 3321 | A2 |
| 3322 | A2 |
| 3323 | A2 |
| 3331 | A2 |
| 3332 | A2 |
| 3333 | A2 |
| 6343 | A2 |
| 6344 | A2 |



## Side AV Panel

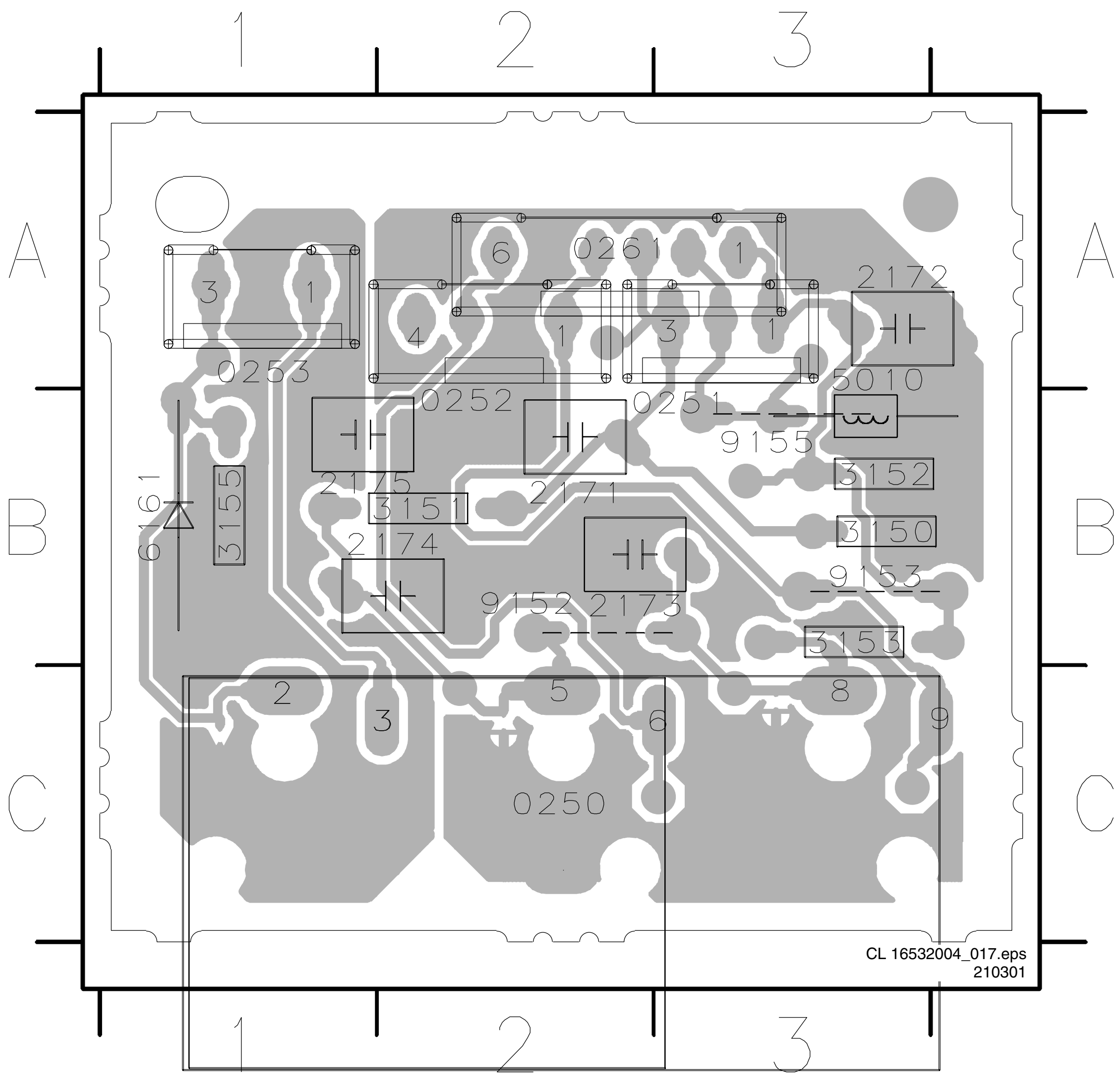



0250-A B1
0250-B C1
0250-C A1
0251 B4
0252 B1
0253 A4
0261 D4
1152 A2
1153 C2
1154 B2
2171 C3
2172 B3
2173 B2
2174 C2
2175 B1
3150 C3
3151 C3
3152 B3
3153 B3
3155 A3
5010 B3
6161 A3
9152 B2
9153 B3
9155 B3

| * For 21" and below | |
|---|---|
| 3150 | 47K |
| 3151 | 1K |
| 3152 | 47K |
| 3153 | 1K |
| 9152 | For mono set w/out front cinch |
| 9153 | For stereo set w/out front cinch |

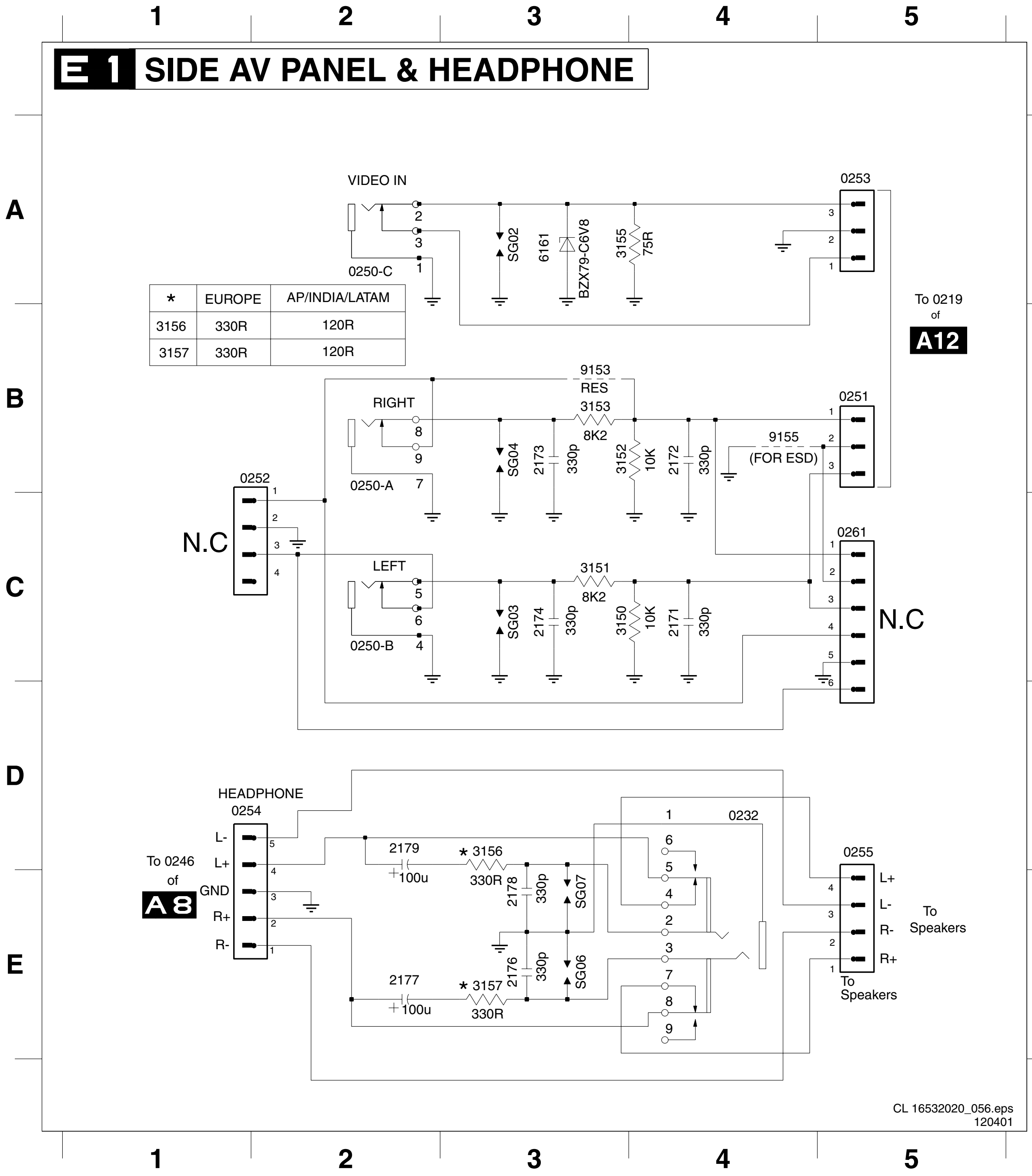
| # For 25" and above | |
|---|---|
| 0251 | For Chassis with Rear Scart |
| 0252 | For Chassis with Rear Scart |
| 0261 | For Chassis with Rear Cinch |
| 6161 | BZX79-C6V8 |

## Layout Side AV Panel



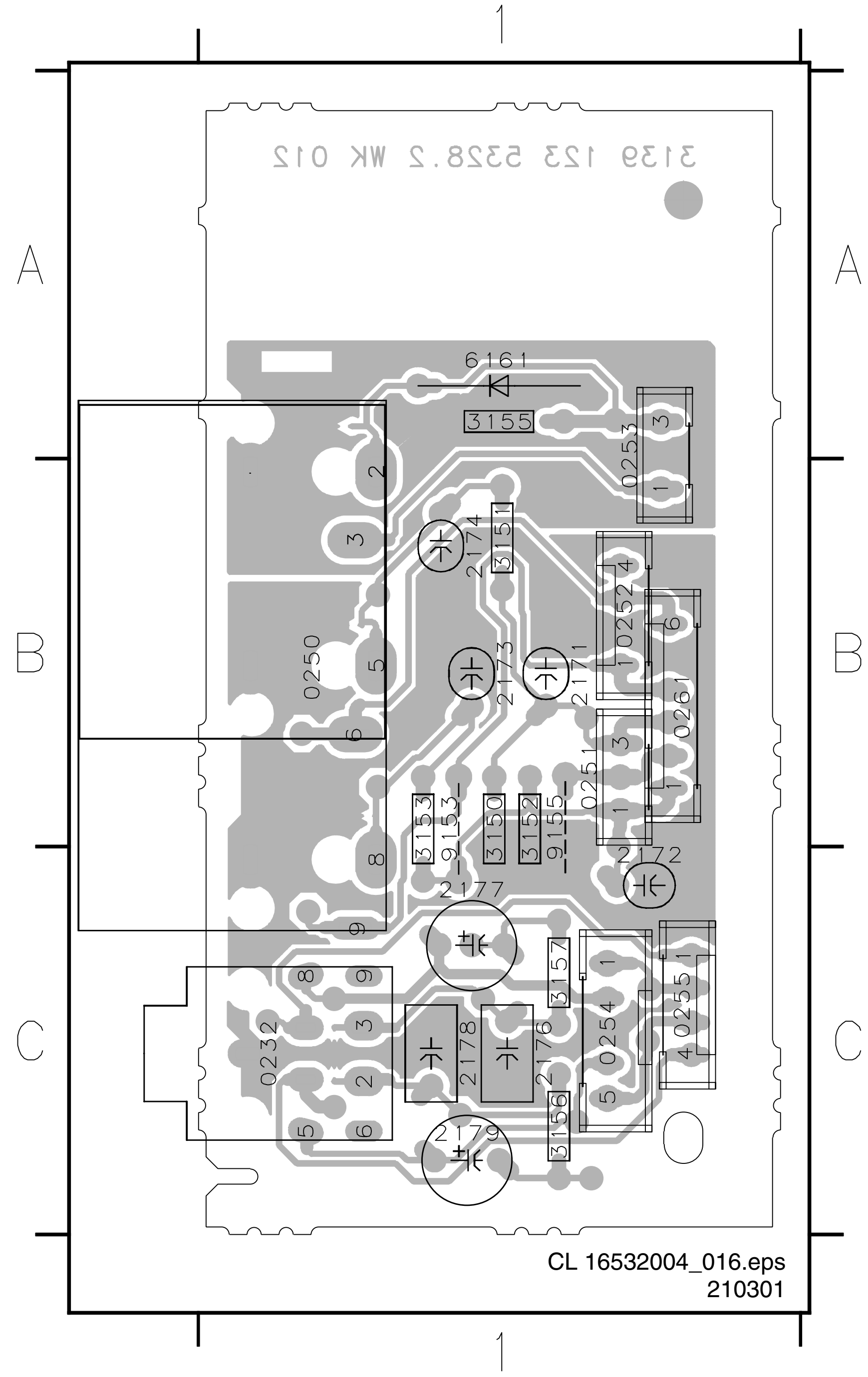

M16 C2
0250 C2
0251 A3
0252 A2
0253 A1
0261 A2
2171 B2
2172 A3
2173 B2
2174 B2
2175 B1
3150 B3
3151 B2
3152 B3
3153 B3
3155 B1
5010 B3
6161 B1
9152 B2
9153 B3
9155 B3

## Side AV Panel + Headphone




0232 D4
0250-A B2
0250-B C2
0250-C A2
0251 B5
0252 B2
0253 A5
0254 D2
0255 D5
0261 C5
2171 C4
2172 B4
2173 B3
2174 C3
2176 E3
2177 E2
2178 E3
2179 D2
3150 C3
3151 C3
3152 B3
3153 B3
3155 A3
3156 D3
3157 E3
6161 A3
9153 B3
9155 B4
SG02 A3
SG03 C3
SG04 B3
SG06 E3
SG07 E3

## Layout Side AV Panel + Headphone




M16 B1
0232 C1
0250 B1
0251 B1
0252 B1
0253 A1
0254 C1
0255 C1
0261 B1
2171 B1
2172 C1
2173 B1
2174 B1
2176 C1
2177 C1
2178 C1
2179 C1
3150 B1
3151 B1
3152 B1
3153 B1
3155 A1
3156 C1
3157 C1
6161 A1
9153 B1
9155 B1

# 8. Alignments

Index of this chapter:
1. General Alignment Conditions
2. Hardware Alignments
3. Software Alignments and Settings

**Note:** The Service Default Alignment Mode (SDAM) is described in the 'Service Modes, Error Codes and Fault Finding' section. SDAM menu navigation is performed by using the MENU UP, MENU DOWN, MENU LEFT, and MENU RIGHT keys of the remote control transmitter.

## 8.1 General Alignment Conditions

Perform all electrical adjustments under the following conditions:
- AC voltage and frequency: 110V (± 10 %), 60Hz (± 5 %).
- Connect the television set to the AC power via an isolation transformer.
- Allow the television set to warm up for approximately 20 minutes.
- Measure the voltages and waveforms in relation to chassis ground (with the exception of the voltages on the primary side of the power supply). Never use heatsinks as ground.
- Test probe: Ri > 10MΩ; Ci < 2.5pF.
- Use an isolated trimmer/screwdriver to perform the alignments.

## 8.2 Hardware Alignments

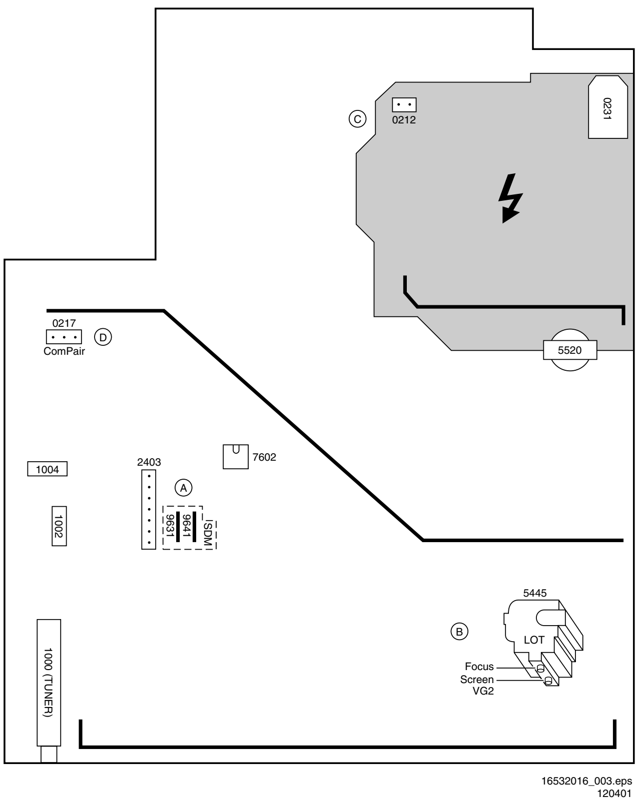
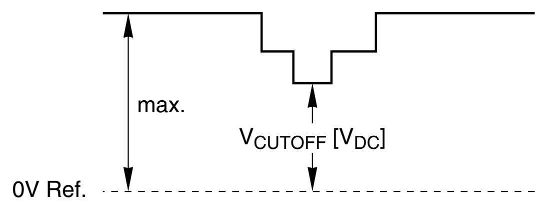



**Figure 8-1 Top view LSP**

### 8.2.1 Vg2 Adjustment

1. Enter SDAM:
   – Press the following key sequence on the remote control transmitter: 0-6-2-5-9-6-MENU
   – Do not allow the display to time out between entries while keying the sequence.
2. Use the MENU UP/DOWN keys to highlight the WHITE TONE sub menu.
3. Press the MENU LEFT or MENU RIGHT key to enter the WHITE TONE sub menu.
4. In the WHITE TONE sub menu, press the MENU UP/ DOWN keys to select NORMAL RED, NORMAL GREEN, or NORMAL BLUE.
5. Use the MENU LEFT/RIGHT keys to set the values of NORMAL RED, NORMAL GREEN and NORMAL BLUE to 40.
6. Press the MENU button twice to enter the normal user menu.
7. In the normal user menu, use the MENU UP/DOWN keys to highlight the PICTURE sub menu (if necessary).
8. Press the MENU LEFT/RIGHT keys to enter the PICTURE sub menu.
9. Use the MENU UP/DOWN keys to select PICTURE. Be sure to record the current value of PICTURE.
10. Use the MENU LEFT/RIGHT keys to set the value of PICTURE to zero.
11. Use the MENU UP/DOWN keys to select BRIGHTNESS. Be sure to record the current value of BRIGHTNESS.
12. Use the MENU LEFT/RIGHT keys to set the value of BRIGHTNESS to minimum (OSD just visible in a dark room).
13. Press the MENU button twice to return to the top level SDAM menu.
14. Press the STATUS/EXIT button to hide the SDAM onscreen display.
15. Connect the RF output of a video pattern generator to the antenna input.
16. Input a 'black picture' test pattern to the television set.
17. Set the oscilloscope to 50 V/div and the time base to 0.2 milliseconds (external triggering on the vertical pulse).
18. Ground the scope at the CRT panel and connect a 10:1 probe to one of the cathodes of the picture tube socket (see schematic diagram B).
19. Measure the cut off pulse during first full line after the frame blanking (see Fig. 8-2). You will see two pulses, one being the cut off pulse and the other being the white drive pulse. Choose the one with the lowest value; this is the cut off pulse.
20. Select the cathode with the highest DC voltage for the alignment. Adjust the Vcutoff of this gun with the SCREEN potentiometer (see Fig. 8-1) on the LOT to the correct value (see table below).
21. Press the STATUS/EXIT button to display the SDAM onscreen display.
22. Press the MENU button to enter the normal user menu.
23. In the normal user menu, use the MENU UP/DOWN keys to highlight the PICTURE sub menu (if necessary).
24. Press the MENU LEFT/RIGHT keys to enter the PICTURE sub menu.
25. Use the MENU UP/DOWN keys to select PICTURE.
26. Use the MENU LEFT/RIGHT keys to reset the value of PICTURE to the original value.
27. Use the MENU UP/DOWN keys to select BRIGHTNESS.
28. Use the MENU LEFT/RIGHT keys to reset the value of BRIGHTNESS to the original value.
29. Press the MENU button twice to return to the top level SDAM menu.
30. Use the POWER button on the remote control transmitter or the POWER button on the television set to turn off the television set. This will save the changes made in SDAM.




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131000

**Figure 8-2 Waveform Vg2 alignment**

**Table 8-1 Overview Vcutoff values**

| Screen Size | Cut-off Voltage |
|---|---|
| 13V/14", 14RF/15RF, 17", 19V/20", 21" | +135V +/- 4V |

### 8.2.2 Focusing

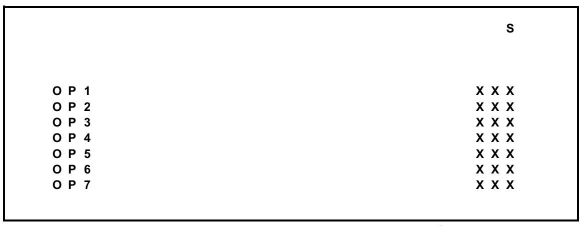
1. Connect the RF output of a video pattern generator to the antenna input.
2. Input a circle or crosshatch test pattern to the television set.
3. Press the AUTO PICTURE button on the remote control transmitter repeatedly to choose PERSONAL or MOVIES picture mode.
4. Adjust the FOCUS potentiometer (see Fig. 8-1) until the vertical lines near the left and right sides of the screen, and near the horizontal center of the screen, are at minimum width without visible haze.

## 8.3 Software Alignments and Settings

The following options are performed in the Service Default Alignment Mode (SDAM). SDAM is described in the 'Service Modes, Error Codes and Fault Finding' section.
The following alignments are explained:

- Options
- Tuner
- White tone
- Geometry
- Audio

### 8.3.1 Options




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260402

**Figure 8-3 Options screen**

Options are used to control the presence or absence of certain features and hardware.

***How to change an Option Byte***
An Option Byte represents a number of different options. Changing these bytes directly makes it possible to set all options very quickly. All options are controlled via seven option bytes.

To change Option Byte(s):

1. Enter SDAM:
   - Press the following key sequence on the remote control transmitter: 0-6-2-5-9-6-MENU
   - Do not allow the display to time out between entries while keying the sequence.
2. Use the MENU UP/DOWN keys to highlight the OPTIONS sub menu.
3. Press the MENU LEFT or MENU RIGHT key to enter the OPTIONS sub menu.
4. In the OPTIONS sub menu, press the MENU UP/DOWN keys to select OP 1 through OP 7.
5. Use the number keys on the remote control transmitter to enter a new value for the selected option byte. The value must be entered as a three-digit value (for example, '4' would be entered as '0-0-4').
6. The selected value must be between 0 and 255.
7. When all desired changes to the option bytes are made, press the MENU button to return to the top level SDAM menu. This will save changes to the option byte settings.
8. To ensure the option byte changes take effect:
   - Turn the television set OFF by using the POWER button on the remote control transmitter or the local keyboard.
   - Disconnect the television set from AC power for at least ten seconds.
   - Reconnect the television set to AC power.
   - Turn the television set ON by using the POWER button on the remote control transmitter or the local keyboard.

| OPTION BYTE STRUCTURE | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | TOTAL VALUE |
| Dec. value | 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 | |
| OB1 | OP17 | OP16 | OP15 | OP14 | OP13 | OP12 | OP11 | OP10 | Sum (OP10 to OP17) |
| OB2 | OP27 | OP26 | OP25 | OP24 | OP23 | OP22 | OP21 | OP20 | Sum (OP20 to OP27) |
| OB3 | OP37 | OP36 | OP35 | OP34 | OP33 | OP32 | OP31 | OP30 | Sum (OP30 to OP37) |
| OB4 | OP47 | OP46 | OP45 | OP44 | OP43 | OP42 | OP41 | OP40 | Sum (OP40 to OP47) |
| OB5 | OP57 | OP56 | OP55 | OP54 | OP53 | OP52 | OP51 | OP50 | Sum (OP50 to OP57) |
| OB6 | OP67 | OP66 | OP65 | OP64 | OP63 | OP62 | OP61 | OP60 | Sum (OP60 to OP67) |
| OB7 | OP77 | OP76 | OP75 | OP74 | OP73 | OP72 | OP71 | OP70 | Sum (OP70 to OP77) |

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100401

**Figure 8-4 Option Byte Structure**

**Table 8-2 Overview option settings**

| Typenumber | OP1 | OP2 | OP3 | OP4 | OP5 | OP6 | OP7 |
|---|---|---|---|---|---|---|---|
| 13L100/85R | 16 | 215 | 1 | 64 | 192 | 153 | 0 |
| 19L135/37R | 0 | 215 | 1 | 64 | 144 | 153 | 0 |
| 19L145/37R | 0 | 215 | 1 | 225 | 144 | 153 | 0 |
| 19L145/85R | 16 | 215 | 1 | 225 | 144 | 153 | 0 |
| 20L135/37R | 0 | 215 | 1 | 64 | 144 | 153 | 0 |
| 20L145/37R | 0 | 215 | 1 | 225 | 180 | 153 | 0 |

***Option Bit Assignment***
Following are the option bit assignments for all L01 software clusters.

- **Option Byte 1 (OB1)**
  - OP10: CHINA
  - OP11: VIRGIN_MODE
  - OP12: UK_PNP
  - OP13: ACI
  - OP14: ATS
  - OP15: LNA
  - OP16: FM_RADIO
  - OP17: PHILIPS_TUNER

- **Option Byte 2 (OB2)**
  - OP20: HUE
  - OP21: COLOR_TEMP
  - OP22: CONTRAST_PLUS
  - OP23: TILT
  - OP24: NOISE_REDUCTION
  - OP25: CHANNEL_NAMING
  - OP26: SMART_PICTURE
  - OP27: SMART_SOUND

- **Option Byte 3 (OB3)**

– OP30: AVL
– OP31: WSSB
– OP32: WIDE_SCREEN
– OP33: SHIFT_HEADER_SUBTITLE
– OP34: CONTINUOUS_ZOOM
– OP35: COMPRESS_16_9
– OP36: EXPAND_4_3
– OP37: EW_FUNCTION

- **Option Byte 4 (OB4)**
  – OP40: STEREO_NON_DBX
  – OP41: STEREO_DBX
  – OP42: STEREO_PB
  – OP43: STEREO_NICAM_2CS
  – OP44: DELTA_VOLUME
  – OP45: ULTRA_BASS
  – OP46: VOLUME_LIMITER
  – OP47: INCR_SUR

- **Option Byte 5 (OB5)**
  – OP50: PIP
  – OP51: HOTEL_MODE
  – OP52: SVHS
  – OP53: CVI
  – OP54: AV3
  – OP55: AV2
  – OP56: AV1
  – OP57: NTSC_PLAYBACK

- **Option Byte 6 (OB6)**
  – OP60: Reserved (value = 0)
  – OP61: SMART_TEXT
  – OP62: SMART_LOCK
  – OP63: VCHIP
  – OP64: WAKEUP_CLOCK
  – OP65: SMART_CLOCK
  – OP66: SMART_SURF
  – OP67: PERSONAL_ZAPPING

- **Option Byte 7 (OB7)**
  – OP70: SOUND_SYSTEM_AP_3 / MULTI_STANDARD_EUR / SYSTEM_LT_2
  – OP71: SOUND_SYSTEM_AP_2 / WEST_EU / SYSTEM_LT_1
  – OP72: SOUND_SYSTEM_AP_1
  – OP73: COLOR_SYSTEM_AP
  – OP74: Reserved (value = 0)
  – OP75: Reserved (value = 0)
  – OP76: TIME_WIN2
  – OP77: TIME_WIN1

***Option bit definition***

- **OP10: CHINA**
  0 : Tuning is not for China set, or this option bit is not applicable,
  1 : Tuning is for China set,
  Default setting : 0.
- **OP11: VIRGIN_MODE**
  0 : Virgin mode is disabled or not applicable,
  1 : Virgin mode is enabled. Plug and Play menu item will be displayed to perform installation at the initial startup of the TV when VIRGIN_MODE is set to 1. After installation is finished, this option bit will be automatically set to 0,
  Default setting : 0.
- **OP12: UK_PNP**
  0 : UK's default Plug and Play setting is not available or not applicable,
  1 : UK's default Plug and Play setting is available. When UK_PNP and VIRGIN_MODE are set to 1 at the initial setup, LANGUAGE = ENGLISH, COUNTRY = GREAT BRITAIN and after exiting from menu, VIRGIN_MODE will be set automatically to 0 while UK_PNP remains 1,
  Default setting : 0.
- **OP13: ACI**
  0 : ACI feature is disabled or not applicable,
  1 : ACI feature is enabled,
  Default setting : 0.
- **OP14: ATS**
  0 :ATS feature is disabled or not applicable,
  1 : ATS feature is enabled. When ATS is enabled, it sorts the program in an ascending order starting from program 1,
  Default setting : 0.
- **OP15: LNA**
  0 :Auto Picture Booster is not available or not applicable,
  1: Auto Picture Booster is available,
  Default setting : 0.
- **OP16: FM_RADIO**
  0 : FM radio feature is disabled or not applicable,
  1 : FM radio feature is enabled,
  Default setting : 0.
- **OP17: PHILIPS_TUNER**
  0 : ALPS / MASCO compatible tuner is in use,
  1 : Philips compatible tuner is in use,
  Default setting : 0.
- **OP20: HUE**
  0 : Hue/Tint Level is disabled or not applicable,
  1 : Hue/Tint Level is enabled,
  Default setting : 0.
- **OP21: COLOR_TEMP**
  0 : Color Temperature is disabled or not applicable,
  1 : Color Temperature is enabled,
  Default setting : 0.
- **OP22: CONTRAST_PLUS**
  0 : Contrast+ is disabled or not applicable,
  1 : Contrast+ is enabled,
  Default setting : 0.
- **OP23: TILT**
  0 : Rotate Picture is disabled or not applicable,
  1 : Rotate Picture is enabled,
  Default setting : 0.
- **OP24: NOISE_REDUCTION**
  0 : Noise Reduction (NR) is disabled or not applicable,
  1 : Noise Reduction (NR) is enabled,
  Default setting : 0.
- **OP25: CHANNEL_NAMING**
  0 : Name FM Channel is disabled or not applicable,
  1 : Name FM Channel is enabled,
  Default setting : 0.
  Note : Name FM channel can be enabled only when FM_RADIO = 1.
- **OP26: SMART_PICTURE**
  0 : Smart Picture is disabled or not applicable,
  1 : Smart Picture is enabled,
  Default setting : 1
- **OP27: SMART_SOUND**
  0 : Smart Sound is disabled or not applicable,
  1 : Smart Sound is enabled,
  Default setting : 1
- **AP30: AVL**
  0 : AVL is disabled or not applicable,
  1 : AVL is enabled,
  Default setting : 0.
- **OP31: WSSB**
  0 : WSSB is disabled or not applicable,
  1 : WSSB is enabled,
  Default setting : 0.
  Note : This option bit can be set to 1 only when WIDE_SCREEN = 1.
- **OP32: WIDE_SCREEN**
  0 : Software is used for 4:3 set or not applicable,
  1 : Software is used for 16:9 set,
  Default setting : 0.
- **OP33: SHIFT_HEADER_SUBTITLE**
  0 : Shift Header / Subtitle is disabled or not applicable,
  1 : Shift Header / Subtitle is enabled,
  Default setting : 0.
  Note : This option bit can be set to 1 only when WIDE_SCREEN = 1.
- **OP34: CONTINUOUS_ZOOM**
  0 : Continuous Zoom is disabled or not applicable,

1 : Continuous Zoom is enabled,
Default setting : 0.
Note : This option bit can be set to 1 only when WIDE_SCREEN = 1.

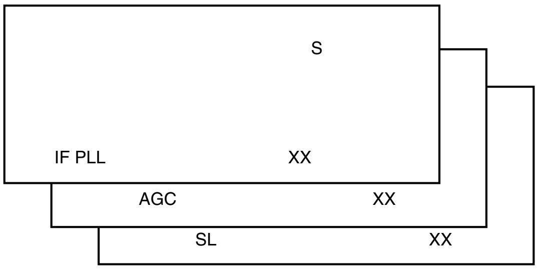
- **OP35: COMPRESS_16_9**
  0 : COMPRESS 16:9 selection is not applicable. Item should not be in the FORMAT menu list,
  1 : COMPRESS 16:9 selection is applicable. Item should not be in the FORMAT menu list,
  Default setting : 0.
- **OP36: EXPAND_4_3**
  0 : Expand 4:3 selection is not applicable. Item should not be in the FORMAT menu list,
  1 : Expand 4:3 selection is applicable. Item should be in the FORMAT menu list,
  Default setting : 0.
- **OP37: EW_FUNCTION**
  0 : EW function is disabled. In this case, only Expand 4:3 is allowed, Compress 16:9 is not applicable.
  1 : EW function is enabled. In this case, both Expand 4:3 and Compress 16:9 are applicable.
  Default setting : 0.
- **OP40: STEREO_NON_DBX**
  0 : For AP_NTSC, chip TDA 9853 is not present,
  1 : For AP_NTSC, chip TDA 9853 is present,
  Default setting : 0.
- **OP41: STEREO_DBX**
  0 : For AP_NTSC, chip MSP 3445 is not present,
  1 : For AP_NTSC, chip MSP 3445 is present,
  Default setting : 0.
- **OP42: STEREO_PB**
  0 : For AP_PAL, chip MSP3465 is not present,
  1 : For AP_PAL, chip MSP3465 is present,
  Default setting : 0.
- **OP43: STEREO_NICAM_2CS**
  0 : For EU and AP_PAL, chip MSP 3415 is not present,
  1 : For EU and AP_PAL, chip MSP 3415 is present,
  Default setting : 0.
- **OP44: DELTA_VOLUME**
  0 : Delta Volume Level is disabled or not applicable,
  1 : Delta Volume Level is enabled,
  Default setting : 0.
- **OP45: ULTRA_BASS**
  0 : Ultra Bass is disabled or not applicable,
  1 : Ultra Bass is enabled,
  Default setting : 0.
- **OP46: VOLUME_LIMITER**
  0 : Volume Limiter Level is disabled or not applicable,
  1 : Volume Limiter Level is enabled,
  Default setting : 0.
- **OP47: INCR_SUR**
  0 : Incredible Surround feature is disabled,
  1 : Incredible Surround feature is enabled,
  Default setting : 1
- **OP50: PIP**
  0 : PIP is disabled or not applicable,
  1 : PIP is enabled,
  Default setting : 0.
- **OP51: HOTEL_MODE**
  0 : Hotel mode is disabled or not applicable,
  1 : Hotel mode is enabled,
  Default setting : 0.
- **OP52: SVHS**
  0 : SVHS source is not available,
  1 : SVHS source is available,
  Default setting : 0.
  Note : This option bit is not applicable for EU.
- **OP53: CVI**
  0 : CVI source is not available,
  1 : CVI source is available,
  Default setting : 0.
- **OP54: AV3**
  0 : Side/Front AV3 source is not present,
  1 : Side/Front AV3 source is present,
  Default setting : 0.
- **OP55: AV2**
  0 : AV2 source is not present,
  1 : AV2 source is present,
  Default setting : 0.
  Note : For EU, when AV2=1, both EXT2 and SVHS2 should be included in the OSD loop.
- **OP56: AV1**
  0 : AV1 source is not present,
  1 : AV1 source is present,
  Default setting : 0.
- **OP57: NTSC_PLAYBACK**
  0 : NTSC playback feature is not available,
  1 : NTSC playback feature is available,
  Default setting : 0.
- **OP60:** Reserved
  Default setting : 0.
- **OP61: SMART_TEXT**
  0 : Smart Text Mode and Favorite Page are disabled or not applicable,
  1 : Smart Text Mode and Favorite Page are enabled,
  Default setting : 1.
- **OP62: SMART_LOCK**
  0 : Child Lock and Lock Channel are disabled or not applicable for EU,
  1 : Child Lock and Lock Channel are enabled for EU,
  Default setting : 1.
- **OP63: VCHIP**
  0 : VCHIP feature is disabled,
  1 : VCHIP feature is enabled, Default setting : 1.
- **OP64: WAKEUP_CLOCK**
  0 : Wake up clock feature is disabled or not applicable,
  1 : Wake up clock feature is enabled,
  Default setting : 1.
- **OP65: SMART_CLOCK**
  0 : Smart Clock Using Teletext and Smart Clock Using PBS is disabled or not applicable,
  1 : Smart Clock Using Teletext and Smart Clock Using PBS is enabled. For NAFTA, menu item AUTOCHRON is present in the INSTALL submenu,
  Default setting : 0.
- **OP66: SMART_SURF**
  0 : Smart Surf feature is disabled or not applicable,
  1 : Smart Surf feature is enabled,
  Default setting : 0.
- **OP67: PERSONAL_ZAPPING**
  0 : Personal Zapping feature is disabled or not applicable,
  1 : Personal Zapping feature is enabled,
  Default setting : 0.
- **OP70: MULTI_STANDARD_EUR**
  0 : Not for Europe multi standard set, or this option bit is not applicable,
  1 : For Europe multi standard set.
  Default setting : 0.
  Note : This option bit is used to control the SYSTEM selection in Manual Store : If MULTI_STANDARD_EUR = 1 then SYSTEM = Europe, West Europe, East Europe, UK, France otherwise SYSTEM = ‘Europe, West Europe, UK for West Europe’ (WEST_EU=1) or SYSTEM = ‘Europe, West Europe, East Europe for East Europe’ (WEST_EU=0)
- **OP71: WEST_EU**
  0 : For East Europe set, or this option bit is not applicable,
  1 : For West Europe set,
  Default setting : 0.
- **OP71 and 70: SYSTEM_LT_1, SYSTEM_LT_2**
  These two option bits are allocated for LATAM system selection.
  00 : NTSC-M
  01 : NTSC-M, PAL-M
  10 : NTSC-M, PAL-M, PAL-N
  11 : NTSC-M, PAL-M, PAL-N, PAL-BG
  Default setting : 00
- **OP70, 71 and 72: SOUND_SYSTEM_AP_1, SOUND_SYSTEM_AP_2, SOUND_SYSTEM_AP_3**

These three option bits are allocated for AP_PAL sound system selection.
000 : BG
001 : BG / DK
010 : I / DK
011 : BG / I / DK
100 : BG / I / DK / M
Default setting : 00

- **OP73: COLOR_SYSTEM_AP**
  This option bit is allocated for AP-PAL color system selection.
  0 : Auto, PAL 4.43, NTSC 4.43, NTSC 3.58
  1 : Auto, PAL 4.43, NTSC 4.43, NTSC 3.58, SECAM
  Default setting : 0
- **OP74:** Reserved
  Default setting : 0.
- **OP75:** Reserved
  Default setting : 0.
- **OP77 and 76: TIME_WIN1, TIME_WIN2**
  00 :The time window is set to 1.2s
  01 : The time window is set to 2s
  10 : The time window is set to 5s
  11 : not in use
  Default setting : 01
  Note :The time-out for all digit entries depend on this setting.

### 8.3.2 Tuner

**Note:** Described alignments are only necessary when the NVM (part reference number 7602) is replaced.




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040402

**Figure 8-5 Tuner alignment screens**

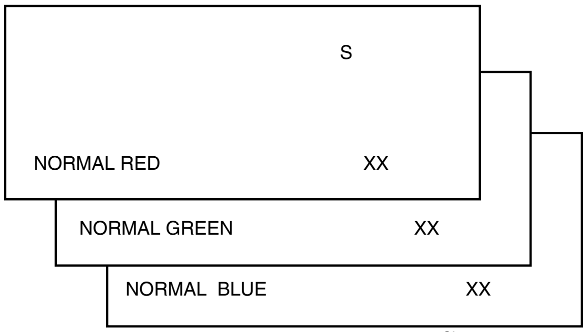
***IF PLL***
This adjustment is auto-aligned. Therefore, no action is required.

***AGC (AGC take over point)***
1. Connect the RF output of a video pattern generator to the antenna input.
2. Input a color bar test pattern to the television set.
3. Set the amplitude of the video pattern generator to 10 mV and set the frequency to 61.25 MHz (channel 3).
4. Connect a DC multimeter to pin 1 of the tuner (item 1000 on the main chassis).
5. Enter SDAM:
   – Press the following key sequence on the remote control transmitter: 0-6-2-5-9-6-MENU
   – Do not allow the display to time out between entries while keying the sequence.
6. Use the MENU UP/DOWN keys to highlight the TUNER sub menu.
7. Press the MENU LEFT/RIGHT keys to enter the TUNER sub menu.
8. Use the MENU UP/DOWN keys to select AGC.
9. Use the MENU LEFT/RIGHT keys to adjust the AGC value (default value is 27) until the voltage at pin 1 of the tuner lies between 3.8V and 2.3V.
10. Press the MENU button to return to the top level SDAM menu.
11. To ensure the AGC change takes effect:
    – Turn the television set OFF by using the POWER button on the remote control transmitter or the local keyboard.
    – Disconnect the television set from AC power for at least ten seconds.
    – Reconnect the television set to AC power.
    – Turn the television set ON by using the POWER button on the remote control transmitter or the local keyboard.

***SL (Slicing Level)***
This adjustment sets the sync slicing level for non-standard signals.
SL should be turned ON to help correct picture instability in premium decoded cable channels.
OFF: slicing level dependent on noise detector
ON: fixed slicing level of 70%

To adjust SL:
1. Enter SDAM:
   – Press the following key sequence on the remote control transmitter: 0-6-2-5-9-6-MENU
   – Do not allow the display to time out between entries while keying the sequence.
2. Use the MENU UP/DOWN keys to highlight the TUNER sub menu.
3. Press the MENU LEFT/RIGHT keys to enter the TUNER sub menu.
4. Use the MENU UP/DOWN keys to select SL.
5. Use the MENU LEFT/RIGHT keys to toggle SL 'Off' and 'On'
6. Press the MENU button to return to the top level SDAM menu.
7. To ensure the SL setting is saved:
   – Turn the television set OFF by using the POWER button on the remote control transmitter or the local keyboard.
   – Disconnect the television set from AC power for at least ten seconds.
   – Reconnect the television set to AC power.
   – Turn the television set ON by using the POWER button on the remote control transmitter or the local keyboard.

### 8.3.3 White Tone




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**Figure 8-6 White tone alignment screens**

The values of the black cut off level can be adjusted in the WHITE TONE sub menu. Normally, no alignment is needed for WHITE TONE, and the given default values are used.

Default settings for NORMAL (color temperature = 9600K):
- NORMAL RED = 40
- NORMAL GREEN = 40
- NORMAL BLUE = 40

To adjust NORMAL RED, NORMAL GREEN, and NORMAL BLUE:

1. Enter SDAM:
   – Press the following key sequence on the remote control transmitter: 0-6-2-5-9-6-MENU
   – Do not allow the display to time out between entries while keying the sequence.
2. Use the MENU UP/DOWN keys to highlight the WHITE TONE sub menu.
3. Press the MENU LEFT/RIGHT keys to enter the WHITE TONE sub menu.
4. Use the MENU UP/DOWN keys to select NORMAL RED, NORMAL GREEN, or NORMAL BLUE.
5. Use the MENU LEFT/RIGHT keys to adjust the value of NORMAL RED, NORMAL GREEN, or NORMAL BLUE.
6. When all desired changes to the WHITE TONE sub menu values are made, press the MENU button to return to the top level SDAM menu.
7. To ensure the WHITE TONE settings are saved:
   – Turn the television set OFF by using the POWER button on the remote control transmitter or the local keyboard.
   – Disconnect the television set from AC power for at least ten seconds.
   – Reconnect the television set to AC power.
   – Turn the television set ON by using the POWER button on the remote control transmitter or the local keyboard.

### 8.3.4 Geometry

The geometry alignments menu contains several items for correct picture geometry alignment.

1. Connect the RF output of a video pattern generator to the antenna input.
2. Input a crosshatch test pattern to the television set.
3. Set the amplitude of the video pattern generator to at least 1mV and set the frequency to 61.25MHz (channel 3).
4. Press the AUTO PICTURE button on the remote control transmitter repeatedly to choose PERSONAL or MOVIES picture mode.
5. Enter SDAM:
   – Press the following key sequence on the remote control transmitter: 0-6-2-5-9-6-MENU
   – Do not allow the display to time out between entries while keying the sequence.
6. Use the MENU UP/DOWN keys to highlight the GEOMETRY sub menu.
7. Press the MENU LEFT/RIGHT keys to enter the GEOMETRY sub menu.
8. Use the MENU UP/DOWN keys to highlight either the HORIZONTAL sub menu or the VERTICAL sub menu.
9. Press the MENU LEFT/RIGHT keys to enter either the HORIZONTAL sub menu or the VERTICAL sub menu.
10. Use the MENU UP/DOWN keys to select items in the HORIZONTAL sub menu or the VERTICAL sub menu.
11. Use the MENU LEFT/RIGHT keys to adjust the values of items in the HORIZONTAL and VERTICAL sub menus.
12. When all desired changes to the HORIZONTAL and VERTICAL sub menu values are made, press the MENU button twice to return to the top level SDAM menu.
13. To ensure the GEOMETRY settings are saved:
   – Turn the television set OFF by using the POWER button on the remote control transmitter or the local keyboard.
   – Disconnect the television set from AC power for at least ten seconds.
   – Reconnect the television set to AC power.
   – Turn the television set ON by using the POWER button on the remote control transmitter or the local keyboard.

The following alignments can be performed in the GEOMETRY sub menu:

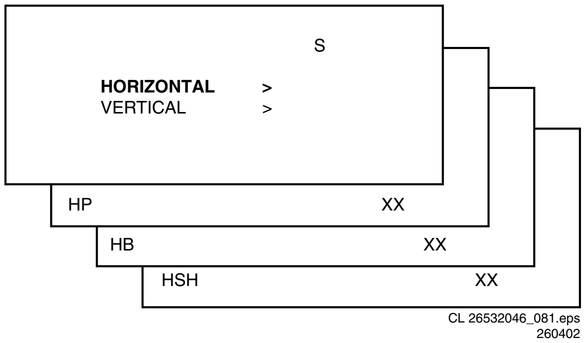



**Figure 8-7 Horizontal geometry alignment screens**

***Horizontal:***
- **Horizontal Parallelogram (HP).** Aligns straight vertical lines at the top and the bottom of the screen; vertical rotation around the center.
- **Horizontal Bow (HB).** Aligns straight horizontal lines at the top and the bottom of the screen; horizontal rotation around the center.
- **Horizontal Shift (HSH).** Aligns the horizontal center of the picture to the horizontal center of the CRT.

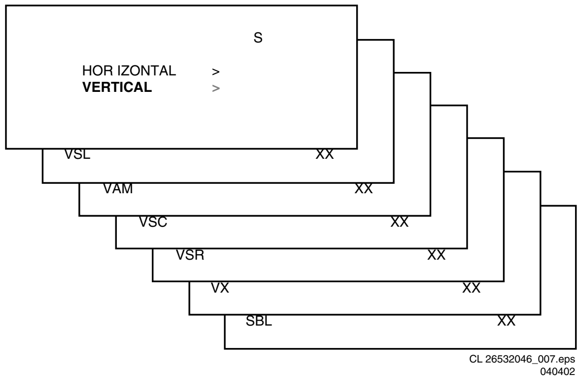



**Figure 8-8 Vertical geometry alignment screens**

***Vertical:***
- **Vertical slope (VSL).** Aligns the picture so the proportions are the same at the top and botton of the screen.This alignment must be performed first, before all other vertical alignments. Turning SBL ON will assist in performing this alignment.
- **Vertical Amplitude (VAM).** Aligns the height of the picture (other vertical alignments are NOT compensated).
- **Vertical S-Correction (VSC).** Aligns the vertical linearity, so that the vertical intervals of the grid-patterns are the same over the entire height of the screen.
- **Vertical Shift (VSH).** Aligns the vertical center of the picture to the vertical center of the CRT. After performing this alignment, it may be necessary to perform the VAM alignment again.
- **Vertical Zoom (VX).** Adjusts picture height.
- **Service blanking (SBL).** Turns the blanking of the lower half of the screen ON or OFF (to be used in combination with the vertical slope alignment).

The table below lists the default GEOMETRY values for the different television sets.

**Table 8-3 Default geometry values**

| Alignment | Description | 13L100/85R Mono | 19L135/37R | 19L145/37R BTSC-NON-DBX | 19L145/85R BTSC-NON-DBX | 20L145/37R BTSC DBX | 20L135/37R |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| HP | Hor. Parallelogram | 31 | 31 | 31 | 31 | 31 | 31 |
| HB | Hor. Bow | 31 | 31 | 31 | 31 | 31 | 31 |
| HSH | Hor. S hift | 23 | 23 | 23 | 23 | 23 | 23 |
| VSL | Vert. Slope | 31 | 38 | 31 | 31 | 31 | 31 |
| VAM | Vert. Amplitude | 26 | 34 | 26 | 26 | 26 | 26 |
| VSC | Vert. S -correction | 23 | 23 | 23 | 23 | 23 | 23 |
| VSH | Vert. S hift | 30 | 35 | 26 | 26 | 26 | 26 |
| VX | Vert. Zoom | 25 | 25 | 25 | 25 | 25 | 25 |

### 8.3.5 Audio

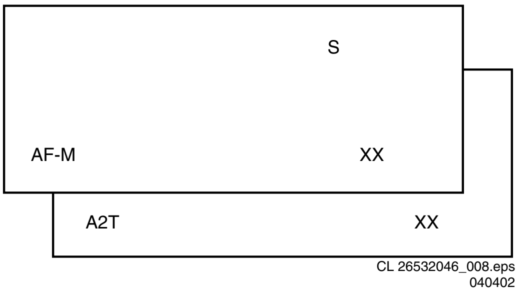



**Figure 8-9 Audio alignment screens**

No alignments are necessary for the AUDIO sub menu. Use the default values.

***AF-M***
Default value is 300.

To adjust AF-M:
1. Enter SDAM:
   – Press the following key sequence on the remote control transmitter: 0-6-2-5-9-6-MENU
   – Do not allow the display to time out between entries while keying the sequence.
2. Use the MENU UP/DOWN keys to highlight the AUDIO sub menu.
3. Press the MENU LEFT/RIGHT keys to enter the AUDIO sub menu.
4. Use the MENU UP/DOWN keys to select AF-M.
5. Use the MENU LEFT/RIGHT keys to adjust the value of AF-M to 300.
6. Press the MENU button to return to the top level SDAM menu.
7. To ensure the AF-M setting is saved:
   – Turn the television set OFF by using the POWER button on the remote control transmitter or the local keyboard.
   – Disconnect the television set from AC power for at least ten seconds.
   – Reconnect the television set to AC power.
   – Turn the television set ON by using the POWER button on the remote control transmitter or the local keyboard.

***A2T (TV A2 Threshold)***
Default value is 250.

To adjust A2T:
1. Enter SDAM:
   – Press the following key sequence on the remote control transmitter: 0-6-2-5-9-6-MENU
   – Do not allow the display to time out between entries while keying the sequence.
2. Use the MENU UP/DOWN keys to highlight the AUDIO sub menu.
3. Press the MENU LEFT/RIGHT keys to enter the AUDIO sub menu.
4. Use the MENU UP/DOWN keys to select A2T.
5. Use the MENU LEFT/RIGHT keys to adjust the value of A2T to 250.
6. Press the MENU button to return to the top level SDAM menu.
7. To ensure the A2T setting is saved:
   – Turn the television set OFF by using the POWER button on the remote control transmitter or the local keyboard.
   – Disconnect the television set from AC power for at least ten seconds.
   – Reconnect the television set to AC power.
   – Turn the television set ON by using the POWER button on the remote control transmitter or the local keyboard.

# 9. Circuit Description

Index of this chapter:
1. Introduction
2. Audio signal processing
3. Video signal processing
4. Synchronization
5. Deflection
6. Power supply
7. Control
8. Abbreviations

**Note**: For a good understanding of the following circuit descriptions, please use the block diagram in chapter 6, or the electrical diagrams in chapter 7. Where necessary, you will find a separate drawing for clarification.

## 9.1 Introduction

The L8/M8 chassis is a global TV chassis for the model year 2001 and is used for TV sets with screen sizes from 14” - 21”. The standard architecture consists of a Main panel, a Picture Tube panel, a Side I/O panel and a Top Control panel.
The Main panel consists primarily of conventional components with hardly any surface mounted devices.

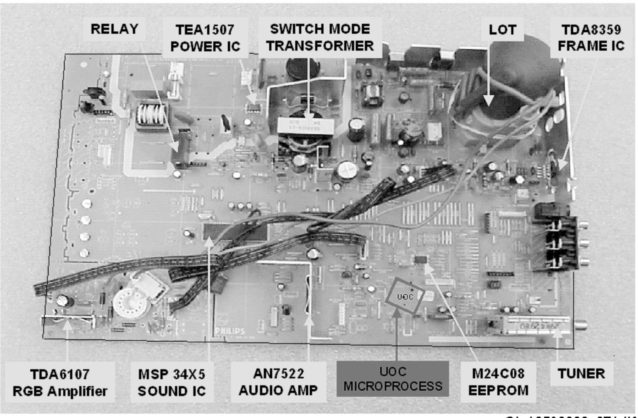



**Figure 9-1**

The functions for video processing, microprocessor ($\mu$P) and teletext (TXT) decoder are combined in one IC (TDA958xH), the so-called Ultimate One Chip (UOC). This chip is (surface) mounted on the copper side of the LSP.

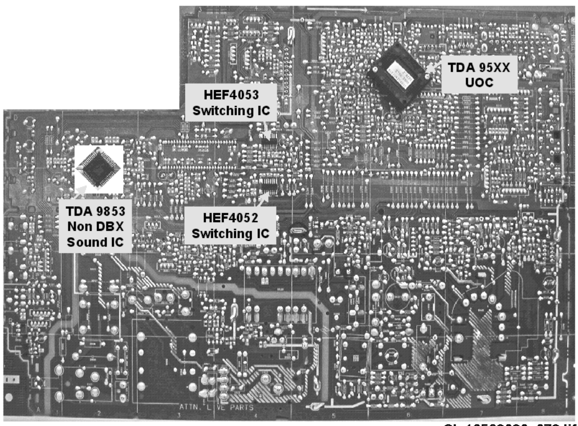



**Figure 9-2**

The L8/M8 is divided into 2 basic systems, i.e. mono and stereo sound. While the audio processing for the mono sound is done in the audio block of the UOC, an external audio processing IC is used for stereo sets.

The tuning system features 181 channels with on-screen display. The main tuning system uses a tuner, a microcomputer, and a memory IC mounted on the main panel. The microcomputer communicates with the memory IC, the customer keyboard, remote receiver, tuner, signal processor IC and the audio output IC via the $I^2C$ bus. The memory IC retains the settings for favorite stations, customer-preferred settings, and service / factory data.
The on-screen graphics and closed caption decoding are done within the microprocessor, and then sent to the signal processor IC to be added to the main signal.

The chassis utilizes a Switching Mode Power Supply (SMPS) for the main voltage source. The chassis has a ‘hot’ ground reference on the primary side and a cold ground reference on the secondary side of the power supply and the rest of the chassis.

## 9.2 Audio Signal Processing

### 9.2.1 Stereo

In stereo sets, the signal goes via the SAW filter (position 1002), to the audio demodulator part of the UOC IC 7200. The audio output on pin 48 goes to the stereo decoder 7831 or 7861. The switch inside this IC selects either the internal decoder or an external source.
There are two stereo decoders used:
1. a BTSC DBX stereo/SAP decoder (MSP34X5 at position 7831) for the highest specified sets and
2. a BTSC non-DBX stereo decoder (TDA 9853 at position 7861) for BTSC Economic.

The output is fed to the to the audio amplifier (AN7522 at position 7901). The volume level is controlled at this IC (pin 9) by a control line (VolumeMute) from the microprocessor. The audio signal from 7901 is then sent to the speaker / headphone output panel.

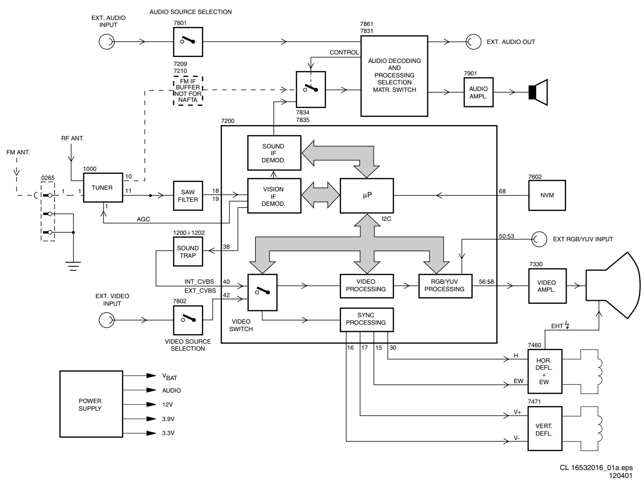



**Figure 9-3**

### 9.2.2 Mono

In mono sets, the signal goes via the SAW filter (position 1002), to the audio demodulator part of the UOC IC 7200. The audio output on pin 48 goes, via the smart sound circuit (7941 for

Bass and 7942 for Treble) and buffer 7943, to the audio amplifier (AN7523 at position 7902).
The volume level is controlled at this IC (pin 9) by a 'VolumeMute' control line from the microprocessor.
The audio signal from IC 7902 is then sent to the speaker / headphone output panel.

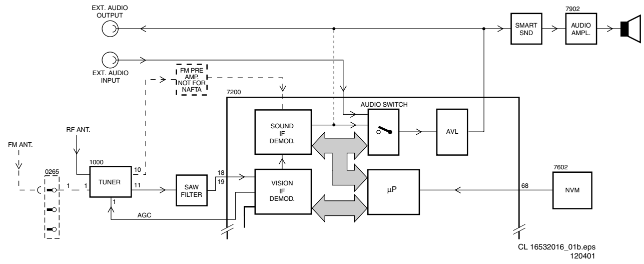



**Figure 9-4**

## 9.3 Video Signal Processing

### 9.3.1 Introduction

The video signal-processing path consists of the following parts:

- RF signal processing.
- Video source selection.
- Video demodulation.
- Luminance / Chrominance signal processing.
- RGB control.
- RGB amplifier

The processing circuits listed above are all integrated in the UOC TV processor. The surrounding components are for the adaptation of the selected application. The $I^2C$ bus is for defining and controlling the signals.

### 9.3.2 RF signal processing

The incoming RF signal goes to the tuner (pos. 1000), where the 45.75 MHz IF signal is developed and amplified. The IF signals then exits the tuner from pin 11 to pass through the SAW filters (pos. 1002). The shaped signal is then applied to the IF processor part of the UOC (pos. 7200).
Tuner AGC (Automatic Gain Control) will reduce the tuner gain and thus the tuner output voltage when receiving strong RF signals. Adjust the AGC takeover point via the Service Alignment Mode (SAM). The tuner AGC starts working when the video-IF input reaches a certain input level. Adjust this level via the $I^2C$ bus. The tuner AGC signal goes to the tuner (pin 1) via the open collector output (pin 22) of the UOC.
The IC also generates an Automatic Frequency Control (AFC) signal that goes to the tuning system via the $I^2C$ bus, to provide frequency correction when needed.
The demodulated composite video signal is available at pin 38 and then buffered by transistor 7201.

### 9.3.3 Video source selection

The Composite Video Blanking Signal (CVBS) from buffer 7201 goes to the audio carrier trap filters (1200, 1201, or 1202 depending on the system used) to remove the audio signal. The signal then goes to pin 40 of IC 7200. The internal input switch selects the following input signals:

- Pin 40: terrestrial CVBS input
- Pin 42: external AV1 CVBS input
- Pin 44: external Side I/O CVBS or AV2 Luminance (Y) input
- Pin 45: external AV2 Chrominance (C) input

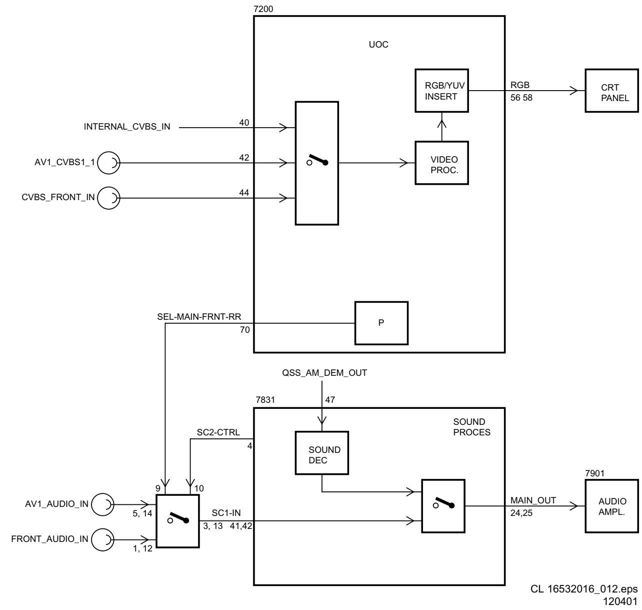



**Figure 9-5**

Once the signal source is selected, a chroma filter calibration is performed. The received color burst sub-carrier frequency is used for this. Correspondingly, the chroma band pass filter for PAL/NTSC processing or the cloche filter for SECAM processing is switched on. The selected luminance (Y) signal is supplied to the horizontal and vertical synchronization processing circuit and to the luminance processing circuit. In the luminance-processing block, the luminance signal goes to the chroma trap filter. This trap is switched 'on' or 'off' depending on the color burst detection of the chroma calibration circuit.
The group delay correction part can be switched between the BG and a flat group delay characteristic. This has the advantage that in multi-standard receivers no compromise has to be made for the choice of the SAW filter.

### 9.3.4 Video demodulation

The color decoder circuit detects whether the signal is a PAL, NTSC or SECAM signal. The result is made known to the auto system manager. The PAL/NTSC decoder has an internal clock generator, which is stabilized to the required frequency by using the 12 MHz clock signal from the reference oscillator of the microcontroller / teletext decoder.
The base-band delay line is used to obtain a good suppression of cross color effects.
The Y signal and the delay line outputs U and V are applied to the luminance / chroma signal processing part of the TV processor.

### 9.3.5 Luminance / Chrominance signal processing

The output of the YUV separator is fed to the internal YUV switch, which switches between the output of the YUV separator or the external YUV (for DVD or PIP) on pins 51-53. Pin 50 is the input for the insertion control signal called 'FBL-1'. When this signal level becomes higher than 0.9 V (but less than 3 V), the RGB signals at pins 51, 52 and 53 are inserted into the picture by using the internal switches.
Also some picture improvement features are implemented in this part:

- **Black stretch** This function corrects the black level of incoming signals, which have a difference between the black level and the blanking level. The amount of extension depends upon the difference between actual black level

and the darkest part of the incoming video signal level. It is detected by means of an internal capacitor.

- **White stretch** This function adapts the transfer characteristic of the luminance amplifier in a non-linear way depending on the average picture content of the luminance signal. It operates in such a way that maximum stretching is obtained when signals with a low video level are received. For bright pictures, stretching is not active.
- **Dynamic skin tone correction**This circuit corrects (instantaneously and locally) the hue of those colors which are located in the area in the UV plane that matches the skin tone. The correction is dependent on the luminance, saturation and distance to the preferred axis.

The YUV signal is then fed to the color matrix circuit, which converts it to R, G and B signals.
The OSD/TXT signal from the microprocessor is mixed with the main signal at this point, before being output to the CRT board (pins 56, 57 and 58).

#### 9.3.6 RGB control

The RGB control circuit enables the picture parameters contrast, brightness and saturation to be adjusted, by using a combination of the user menus and the remote control. Additionally automatic gain control for the RGB signals via cut-off stabilization is achieved in this functional block to obtain an accurate biasing of the picture tube. Therefor this block inserts the cut-off point measuring pulses into the RGB signals during the vertical retrace period.

The following additional controls are used:

- **Black current calibration loop** Because of the 2-point black current stabilization circuit, both the black level and the amplitude of the RGB output signals depend on the drive characteristics of the picture tube. The system checks whether the returning measuring currents meet the requirements, and adapt the output level and gain of the circuit when necessary. After stabilization of the loop, the RGB drive signals are switched on. The 2-point black level system adapts the drive voltage for each cathode in such a way that the two measuring currents have the right value. This is done with the measurement pulses during the frame flyback. During the first frame, three pulses with a current of 8 µA are generated to adjust the cut off voltage. During the second frame, three pulses with a current of 20 µA are generated to adjust the ‘white drive’. This has as a consequence, that a change in the gain of the output stage will be compensated by a gain change of the RGB control circuit. Pin 55 (BLKIN) of the UOC is used as the feedback input from the CRT base panel.
- **Blue stretch** This function increases the color temperature of the bright scenes (amplitudes which exceed a value of 80% of the nominal amplitude). This effect is obtained by decreasing the small signal gain of the red and green channel signals, which exceed this 80% level.
- **Beam current limiting** A beam current limiting circuit inside the UOC handles the contrast and brightness control for the RGB signals. This prevents the CRT from being overdriven, which could otherwise cause serious damage in the line output stage. The reference used for this purpose is the DC voltage on pin 54 (BLCIN) of the TV processor. Contrast and brightness reduction of the RGB output signals is therefore proportional to the voltage present on this pin. Contrast reduction starts when the voltage on pin 54 is lower than 2.8 V. Brightness reduction starts when the voltage on pin 54 is less than 1.7 V. The voltage on pin 54 is normally 3.3 V (limiter not active). During set switch-off, the black current control circuit generates a fixed beam current of 1 mA. This current ensures that the picture tube capacitance is discharged. During the switch-off period, the vertical deflection is placed in an over-scan position, so that the discharge is not visible on the screen.

#### 9.3.7 RGB amplifier

From outputs 56, 57 and 58 of IC 7200 the RGB signals are applied to the analog output amplifiers on the CRT panel. The R-signal is amplified by a circuit build around transistors Q7311, 7312 and 7313, which drives the picture tube cathodes. The supply voltage for the amplifier is +160 V and is derived from the line output stage.

## 9.4 Synchronization

Inside IC 7200 part D the vertical and horizontal sync pulses are separated. These ‘H’ and ‘V’ signals are synchronised with the incoming CVBS signal. They are then fed to the H- and V-drive circuits and to the OSD/TXT circuit for synchronization of the On Screen Display and Teletext (CC) informationrmation.

## 9.5 Deflection

#### 9.5.1 Horizontal drive

The horizontal drive signal is obtained from an internal VCO, which is running at twice the line frequency. This frequency is divided by two, to lock the first control loop to the incoming signal.
When the IC is switched ‘on’, the ‘Hdrive’ signal is suppressed until the frequency is correct.
The ‘Hdrive’ signal is available at pin 30. The ‘Hflybk’ signal is fed to pin 31 to phase lock the horizontal oscillator, so that Q7462 cannot switch ‘on’ during the flyback time.
The ‘EWdrive’ signal for the E/W circuit (if present) is available on pin 15, where it drives transistor 7400 to make linearity corrections in the horizontal drive.

When the set is switched on, the ‘+8V’ voltage goes to pin 9 of IC 7200. The horizontal drive starts up in a soft start mode. It starts with a very short $T_{ON}$ time of the horizontal output transistor. The $T_{OFF}$ of the transistor is identical to the time in normal operation. The starting frequency during switch on is therefore about 2 times higher than the normal value. The ‘on’ time is slowly increased to the nominal value in 1175 ms. When the nominal value is reached, the PLL is closed in such a way that only very small phase corrections are necessary.

The ‘EHTinformation’ line on pin 11 is intended to be used as a ‘X-ray’ protection. When this protection is activated (when the voltage exceeds 6 V), the horizontal drive (pin 30) is switched 'off' immediately. If the ‘H-drive’ is stopped, pin 11 will become low again. Now the horizontal drive is again switched on via the slow start procedure.
The ‘EHTinformation’ line (Aquadag) is also fed back to the UOC IC 7200 pin 54, to adjust the picture level in order to compensate for changes in the beam current.

The ‘filament’ voltage is monitored for ‘no voltage’ or ‘excessive voltage’. This voltage is rectified by diode 6447 and fed to the emitter of transistor 7443. If this voltage goes above 6.8 V, transistor 7443 will conduct, making the ‘EHT0’ line ‘high’. This will immediately switch off the horizontal drive (pin 30) via the slow stop procedure.

The horizontal drive signal exits IC 7200 at pin 30 and goes to 7462, the horizontal driver transistor. The signal is amplified and coupled to the base circuit of 7460, the horizontal output transistor. This will drive the line output transformer (LOT) and associated circuit. The LOT provides the extra high voltage (EHT), the VG2 voltage and the focus and filament voltages for the CRT, while the line output circuit drives the horizontal deflection coil.

#### 9.5.2 Vertical drive

A divider circuit performs the vertical synchronization. The vertical ramp generator needs an external resistor (R3245, pin 20) and capacitor (C2244, pin 21). A differential output is available at pins 16 and 17, which are DC-coupled with the vertical output stage.
During the insertion of RGB signals, the maximum vertical frequency is increased to 72 Hz so that the circuit can also synchronize on signals with a higher vertical frequency like VGA.
To avoid damage of the picture tube when the vertical deflection fails, the guard output is fed to the beam current limiting input. When a failure is detected the RGB-outputs are blanked. When no vertical deflection output stage is connected this guard circuit will also blank the output signals.

These ‘V_DRIVE+’ and ‘V_DRIVE-‘ signals are applied to the input pins 7 and 1 of IC 7471 (vertical deflection amplifier). These are voltage driven differential inputs. As the driver device (IC 7200) delivers output currents, R3473 and R3475 convert them to voltage. The differential input voltage is compared with the voltage across measuring resistor R3471 that provides internal feedback informationrmation. The voltage across this measuring resistor is proportional to the output current, which is available at pin 5 where it drives the vertical deflection coil (connector 0222).
IC 7471 is supplied by +/-13 V. The vertical flyback voltage is generated at pin 3.

## 9.6 Power Supply

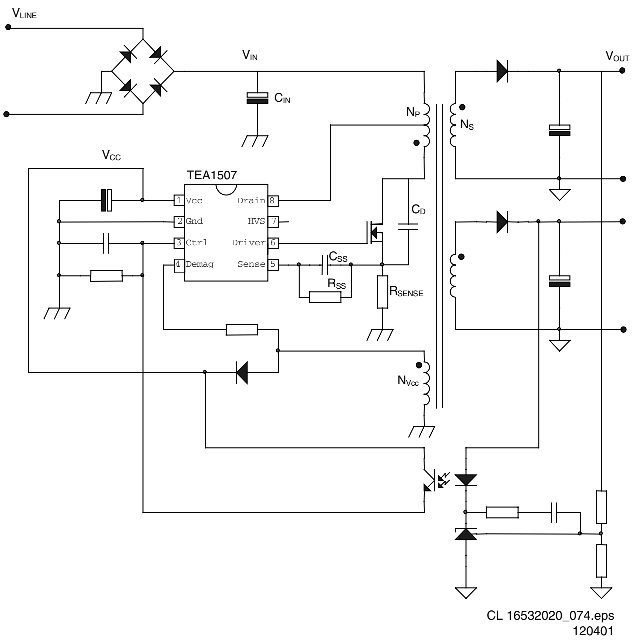



Figure 9-6

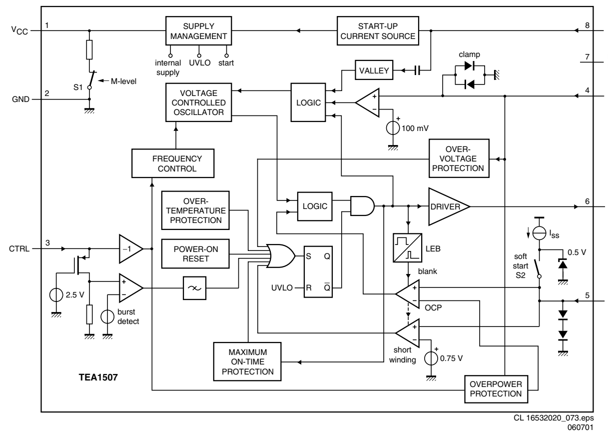



Figure 9-7

#### 9.6.1 Introduction

The supply is a Switching Mode Power Supply (SMPS). The frequency of operation varies with the circuit load. This ‘Quasi-Resonant Flyback’ behavior has some important benefits compared to a ‘hard switching’ fixed frequency Flyback converter. The efficiency can be improved up to 90%, which results in lower power consumption. Moreover the supply runs cooler and safety is enhanced.
The power supply starts operating when a DC voltage goes from the rectifier bridge via T5520, R3532 to pin 8. The operating voltage for the driver circuit is also taken from the ‘hot’ side of this transformer.

The switching regulator IC 7520 starts switching the FET ‘on’ and ‘off’, to control the current flow through the primary winding of transformer 5520. The energy stored in the primary winding during the ‘on’ time is delivered to the secondary windings during the ‘off’ time.
The ‘MainSupply’ line is the reference voltage for the power supply. It is sampled by resistors 3543 and 3544 and fed to the input of the regulator 7540 / 6540. This regulator drives the feedback optocoupler 7515 to set the feedback control voltage on pin 3 of 7520.
The power supply in the set is ‘on’ any time AC power goes to the set.

***Derived Voltages***
The voltages supplied by the secondary windings of T5520 are:

- ‘MainAux’ for the audio circuit (voltage depends on set execution, see table below),
- 3.3 V and 3.9 V for the microprocessor and
- ‘MainSupply’ for the horizontal output (voltage depends on set execution, see table below).

Other supply voltages are provided by the LOT. It supplies +50 V (only for large screen sets), +13 V, +8 V, +5 V and a +200 V source for the video drive. The secondary voltages of the LOT are monitored by the ‘EHTinformation’ lines. These lines are fed to the video processor part of the UOC IC 7200 on pins 11 and 34.
This circuit will shut ‘off’ the horizontal drive in case of over-voltage or excessive beam current.

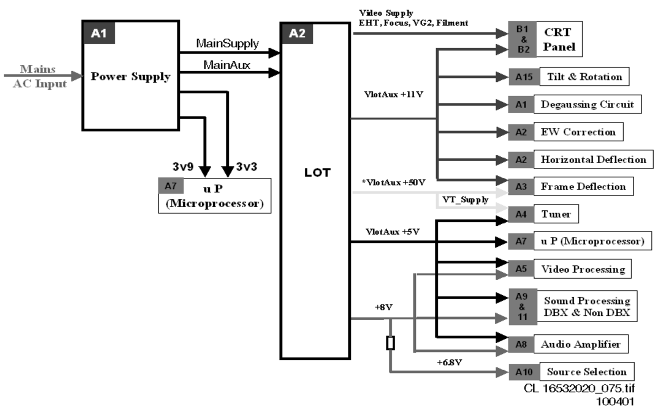



Figure 9-8

| Power supply voltages | | | | |
|---|---|---|---|---|
| Screen Size | Voltage name | Measuring point | Value | Remark |
| 14", 15RF, 17", 20", 21" | MainSupply | P6 (C2561) | 95 V | |
| | MainAux | P5 (C2564) | 11 V | Stereo 2x3 W and Mono 1x2 W, 3 W, 4 W |
| | | | 10 V | Stereo 2x1 W and Mono 1x1 W |
| All others | MainSupply | P6 (C2561) | 130 V | 21/25/29RF and 25/27/32/35V |
| | | | 143 V | 25/28/29SF, 25/28BLD, 25/28BLS, 28/32WS, 24/28BLDWS & BLSWS |
| | MainAux | P5 (C2564) | 12 V | Stereo 2x1 W, 3 W, 5 W |
| | | | 10 V | Mono 1x1 W |

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110401

Figure 9-9

### *Degaussing*

When the set is switched on, the degaussing relay 1515 is immediately activated as transistor 7580 is conducting. Due to the RC-time of R3580 and C2580, it will last about 3 to 4 seconds before transistor 7580 is switched off.

### 9.6.2 Basic IC Functionality

For a clear understanding of the Quasi-Resonant behavior, it is possible to explain it by a simplified circuit diagram (see Figure below). In this circuit diagram, the secondary side is transferred to the primary side and the transformer is replaced by an inductance $L_P$. $C_D$ is the total drain capacitance including the resonance capacitor $C_R$, parasitic output capacitor $C_{OSS}$ of the MOSFET and the winding capacitance $C_W$ of the transformer. The turns ratio of the transformer is represented by n ($N_P/N_S$).

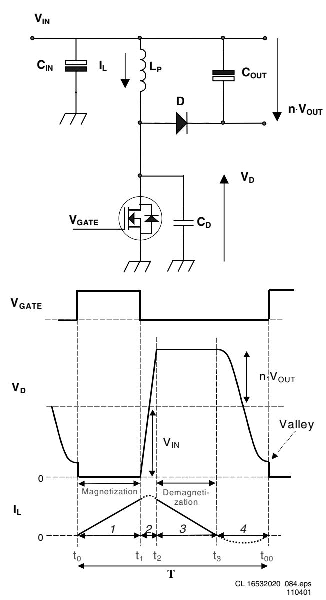



Figure 9-10

In the Quasi-Resonant mode each period can be divided into four different time intervals, in chronological order:

- **Interval 1: t0 < t < t1 primary stroke** At the beginning of the first interval, the MOSFET is switched 'on' and energy is stored in the primary inductance (magnetization). At the end, the MOSFET is switched 'off' and the second interval starts.
- **Interval 2: t1 < t < t2 commutation time** In the second interval, the drain voltage will rise from almost zero to $V_{IN}$+n•($V_{OUT}$ +$V_F$). $V_F$ is the forward voltage drop of de diode that will be omitted from the equations from now on. The current will change its positive derivative, corresponding to $V_{IN}/L_P$, to a negative derivative, corresponding to -n•$V_{OUT}$ /$L_P$.
- **Interval 3: t2 < t < t3 secondary stroke** In the third interval, the stored energy is transferred to the output, so the diode starts to conduct and the inductive current $I_L$ will decrease. In other words, the transformer will be demagnetized. When the inductive current has become zero the next interval begins.
- **Interval 4: t3 < t < t00 resonance time** In the fourth interval, the energy stored in the drain capacitor $C_D$ will start to resonate with the inductance $L_P$. The voltage and current waveforms are sinusoidal waveforms. The drain voltage will drop from $V_{IN}$+n•$V_{OUT}$ to $V_{IN}$-n•$V_{OUT}$.

### *Frequency Behavior*

The frequency in the QR-mode is determined by the power stage and is not influenced by the controller (important parameters are $L_P$ and $C_D$). The frequency varies with the input voltage $V_{IN}$ and the output power $P_{OUT}$. If the required output power increases, more energy has to be stored in the transformer. This leads to longer magnetizing $t_{PRIM}$ and demagnetizing $t_{SEC}$ times, which will decrease the frequency. See the frequency versus output power characteristics below. The frequency characteristic is not only output power-, but also input voltage dependent. The higher the input voltage, the smaller $t_{PRIM}$, so the higher the frequency will be.

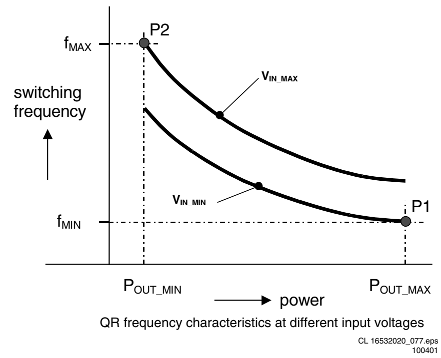



Figure 9-11

Point P1 is the minimum frequency $f_{MIN}$ that occurs at the specified minimum input voltage and maximum output power required by the application. Of course the minimum frequency has to be chosen above the audible limit (>20 kHz).

### *Start-Up Sequence*

When the rectified AC voltage $V_{IN}$ (via the center tap connected to pin 8) reaches the Mains dependent operation level (Mlevel: between 60 and 100 V), the internal 'Mlevel switch' will be opened and the start-up current source is enabled to charge capacitor C2521 at the $V_{CC}$ pin as shown below.
The 'soft start' switch is closed when the $V_{CC}$ reaches a level of 7 V and the 'soft start' capacitor $C_{SS}$ (C2522, between pin 5 and the sense resistor R3526), is charged to 0.5 V.
Once the $V_{CC}$ capacitor is charged to the start-up voltage $V_{CC-start}$ (11 V), the IC starts driving the MOSFET. Both internal current sources are switched 'off' after reaching this start-up voltage. Resistor $R_{SS}$ (3524) will discharge the 'soft start'

capacitor, such that the peak current will slowly increase. This to prevent ‘transformer rattle’.
During start-up, the $V_{CC}$ capacitor will be discharged until the moment that the primary auxiliary winding takes over this voltage.

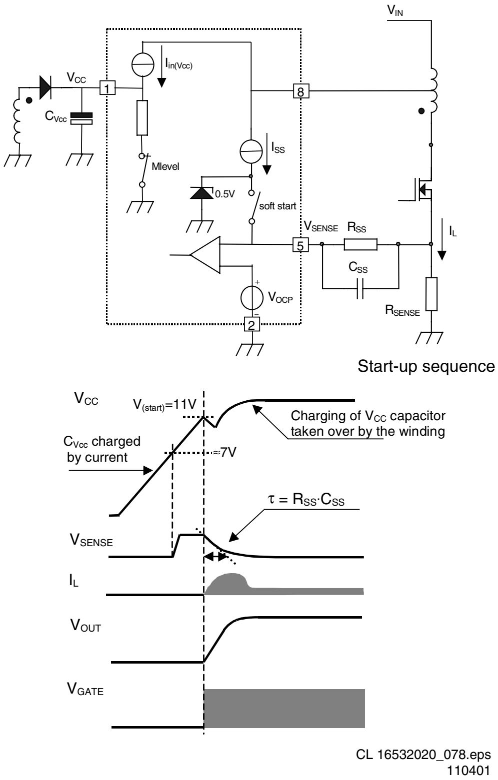



**Figure 9-12**

The moment that the voltage on pin 1 drops below the ‘under voltage lock out‘ level (UVLO = ± 9 V), the IC will stop switching and will enter a safe restart from the rectified mains voltage.

***Operation***
The supply can run in three different modes depending on the output power:

- **Quasi-Resonant mode (QR)** The QR mode, described above, is used during normal operation. This will give a high efficiency.
- **Frequency Reduction mode (FR)** The FR mode (also called VCO mode) is implemented to decrease the switching losses at low output loads. In this way the efficiency at low output powers is increased, which enables power consumption smaller than 3 W during stand-by. The voltage at the pin 3 (Ctrl) determines where the frequency reduction starts. An external Ctrl voltage of 1.425 V corresponds with an internal VCO level of 75 mV. This fixed VCO level is called $V_{VCO,start}$ . The frequency will be reduced in relation to the VCO voltage between 75 mV and 50 mV (at levels larger than 75 mV, Ctrl voltage < 1.425V, the oscillator will run on maximum frequency $f_{oscH}$ = 175 kHz typically). At 50 mV ($V_{VCO,max}$) the frequency is reduced to the minimum level of 6 kHz. Valley switching is still active in this mode.
- **Minimum Frequency mode (MinF)** At VCO levels below 50 mV, the minimum frequency will remain on 6 kHz, which is called the MinF mode. Because of this low frequency, it is possible to run at very low loads without having any output regulation problems.

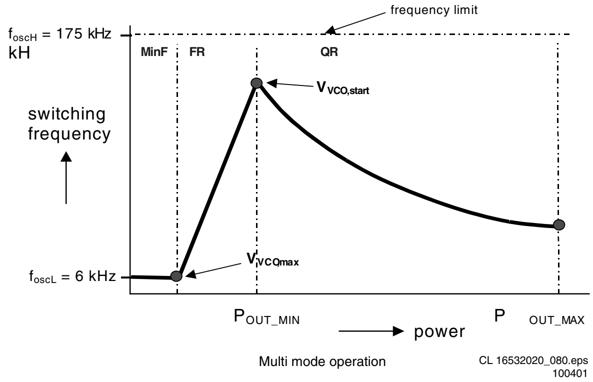



**Figure 9-13**

***Safe-Restart Mode***
This mode is introduced to prevent the components from being destroyed during eventual system fault conditions. It is also used for the Burst mode. The Safe-Restart mode will be entered if it is triggered by one of the following functions:

- Over voltage protection,
- Short winding protection,
- Maximum ‘on time’ protection,
- $V_{CC}$ reaching UVLO level (fold back during overload),
- Detecting a pulse for Burst mode,
- Over temperature protection.

When entering the Safe-Restart mode, the output driver is immediately disabled and latched. The $V_{CC}$ winding will not charge the $V_{CC}$ capacitor anymore and the $V_{CC}$ voltage will drop until UVLO is reached. To recharge the $V_{CC}$ capacitor, the internal current source ($I_{(restart)(VCC)}$ ) will be switched ‘on’ to initiate a new start-up sequence as described before. This Safe-Restart mode will persist until the controller detects no faults or burst triggers.

***Standby***
The set goes to Standby in the following cases:

- After pressing the ‘standby’ key on the remote control.
- When the set is in protection mode.

In Standby, the power supply works in ‘burst mode’.
Burst mode can be used to reduce the power consumption below 1 W at stand-by. During this mode, the controller is active (generating gate pulses) for only a short time and for a longer time inactive waiting for the next burst cycle.
In the active period the energy is transferred to the secondary and stored in the buffer capacitor $C_{STAB}$ in front of the linear stabilizer (see Figure below). During the inactive period, the load (e.g. microprocessor) discharges this capacitor. In this mode, the controller makes use of the Safe-Restart mode.

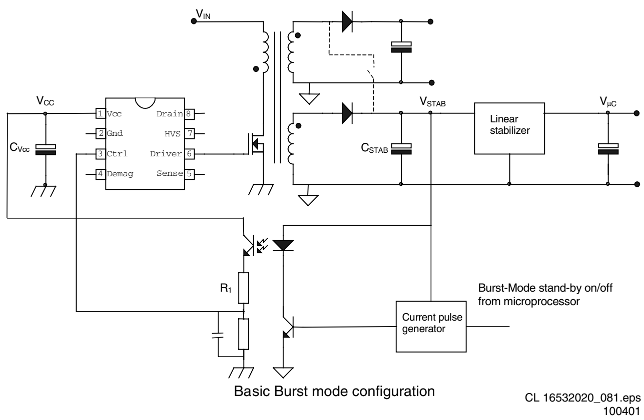



**Figure 9-14**

The system enters burst mode standby when the microprocessor activates the 'Stdby_con' line. When this line is pulled high, the base of Q7541 is allowed to go high. This is triggered by the current from collector Q7542. When Q7541 turns 'on', the opto-coupler (7515) is activated, sending a large current signal to pin 3 (Ctrl). In response to this signal, the IC stops switching and enters a 'hiccup' mode. This burst activation signal should be present for longer than the 'burst blank' period (typically 30 $\mu$s): the blanking time prevents false burst triggering due to spikes.
Burst mode standby operation continues until the microcontroller pulls the 'Stdby_con' signal low again. The base of Q7541 is unable to go high, thus cannot turn 'on'. This will disable the burst mode. The system then enters the start-up sequence and begins normal switching behavior.

For a more detailed description of one burst cycle, three time intervals are defined:

- **t1: Discharge of $V_{CC}$ when gate drive is active** During the first interval, energy is transferred, which result in a ramp-up of the output voltage ($V_{STAB}$) in front of the stabilizer. When enough energy is stored in the capacitor, the IC will be switched 'off' by a current pulse generated at the secondary side. This pulse is transferred to the primary side via the opto coupler. The controller will disable the output driver (safe restart mode) when the current pulse reaches a threshold level of 16 mA into the Ctrl pin. A resistor $R_1$ (R3519) is placed in series with the opto coupler, to limit the current going into the Ctrl pin. Meanwhile the $V_{CC}$ capacitor is discharged but has to stay above $V_{UVLO}$ .
- **t2: Discharge of $V_{CC}$ when gate drive is inactive** During the second interval, the $V_{CC}$ is discharged to $V_{UVLO}$. The output voltage will decrease depending on the load.
- **t3: Charge of $V_{CC}$ when gate drive is inactive** The third interval starts when the UVLO is reached. The internal current source charges the $V_{CC}$ capacitor (also the soft start capacitor is recharged). Once the $V_{CC}$ capacitor is charged to the start-up voltage, the driver is activated and a new burst cycle is started.

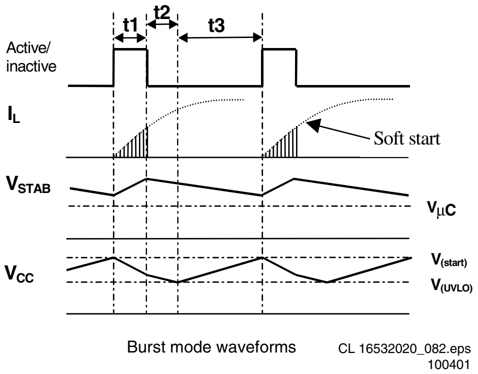



**Figure 9-15**

### 9.6.3 Protection Events

The SMPS IC 7520 has the following protection features:

***Demagnetization sense***

This feature guarantees discontinuous conduction mode operation in every situation. The oscillator will not start a new primary stroke until the secondary stroke has ended. This is to ensure that FET 7521 will not turn on until the demagnetization of transformer 5520 is complete.The function is an additional protection feature against:

- saturation of the transformer,
- damage of the components during initial start-up,
- an overload of the output.

The demag(netization) sense is realized by an internal circuit that guards the voltage (Vdemag) at pin 4 that is connected to $V_{CC}$ winding by resistor $R_1$ (R3522). The Figure below shows the circuit and the idealized waveforms across this winding.

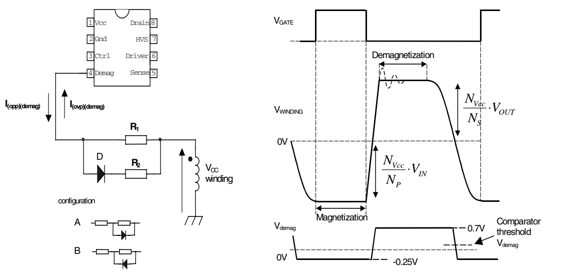



**Figure 9-16**

***Over Voltage Protection***

The Over Voltage Protection ensures that the output voltage will remain below an adjustable level. This works by sensing the auxiliary voltage via the current flowing into pin 4 (DEM) during the secondary stroke. This voltage is a well-defined replica of the output voltage. Any voltage spikes are averaged by an internal filter.
If the output voltage exceeds the OVP trip level, the OVP circuit switches the power MOSFET 'off'.
Next, the controller waits until the 'under voltage lock out' level (UVLO = $\pm$ 9 V) is reached on pin 1 ($V_{CC}$). This is followed by a safe restart cycle, after which switching starts again. This process is repeated as long as the OVP condition exists. The output voltage at which the OVP function trips, is set by the demagnetization resistor R3522.

***Over Current Protection***

The internal OCP protection circuit limits the 'sense' voltage on pin 5 to an internal level.

***Over Power Protection***

During the primary stroke, the rectified AC input voltage is measured by sensing the current drawn from pin 4 (DEM). This current is dependent on the voltage on pin 9 of transformer 5520 and the value of R3522. The current informationrmation is used to adjust the peak drain current, which is measured via pin $I_{SENSE}$.

***Short Winding Protection***

If the 'sense' voltage on pin 5 exceeds the short winding protection voltage (0.75 V), the converter will stop switching. Once $V_{CC}$ drops below the UVLO level, capacitor C2521 will be recharged and the supply will start again. This cycle will be repeated until the short circuit is removed (safe restart mode). The short winding protection will also protect in case of a secondary diode short circuit.
This protection circuit is activated after the leading edge blanking time (LEB).

***LEB time***

The LEB (Leading Edge Blanking) time is an internally fixed delay, preventing false triggering of the comparator due to current spikes. This delay determines the minimum 'on' time of the controller.

***Over Temperature protection***

When the junction temperature exceeds the thermal shutdown temperature (typ. 140º C), the IC will disable the driver. When the $V_{CC}$ voltage drops to UVLO, the $V_{CC}$ capacitor will be recharged to the $V_{(start)}$ level. If the temperature is still too high, the $V_{CC}$ voltage will drop again to the UVLO level (Safe-Restart mode). This mode will persist until the junction temperature drops 8 degrees typically below the shutdown temperature.

***Mains dependent operation enabling level***
To prevent the supply from starting at a low input voltage, which could cause audible noise, a mains detection is implemented (Mlevel). This detection is provided via pin 8, that detects the minimum start-up voltage between 60 and 100 V. As previous mentioned, the controller is enabled between 60 and 100 V. An additional advantage of this function is the protection against a disconnected buffer capacitor ($C_{IN}$). In this case, the supply will not be able to start-up because the $V_{CC}$ capacitor will not be charged to the start-up voltage.

## 9.7 Control

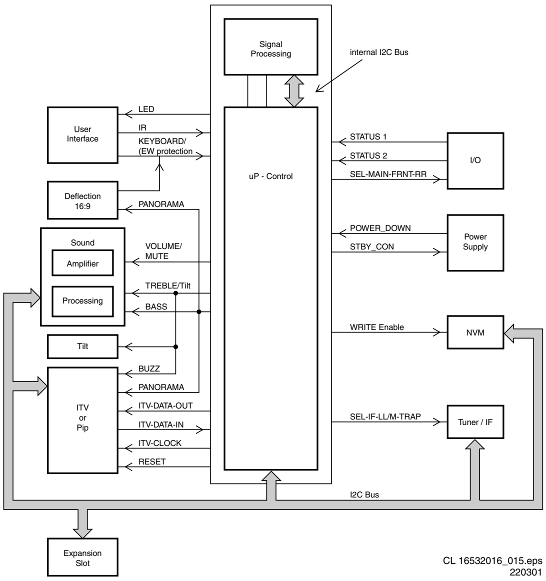



**Figure 9-17**

### 9.7.1 Introduction

The microprocessor part of the UOC, has the complete control and teletext on board. User menu, Service Default Mode, Service Alignment Mode and Customer Service Mode are generated by the µP. Communication to other ICs is done via the $I^2C$-bus.

### 9.7.2 I²C-Bus

The main control system, which consists of the microprocessor part of the UOC (7200), is linked to the external devices (tuner, NVM, MSP, etc) by means of the $I^2C$-bus. An internal $I^2C$-bus is used to control other signal processing functions, like video processing, sound IF, vision IF, synchronization, etc.

### 9.7.3 User Interface

The L8/M8 uses a remote control with RC5 protocol. The incoming signal is connected to pin 67 of the UOC.

The 'Top Control' keyboard, connected to UOC pin 80, can also control the set. Button recognition is done via a voltage divider.

The front LED (6691) is connected to an output control line of the microprocessor (pin 5). It is activated to provide the user information about whether or not the set is working correctly (e.g., responding to the remote control, normal operation (USA only) or fault condition)

### 9.7.4 In- And Output Selection

For the control of the input and output selections, there are three lines:

- **STATUS1** This signal provides informationrmation to the microprocessor on whether a video signal is available on the SCART1 AV input and output port (only for Europe). This signal is not connected in NAFTA sets.
- **STATUS2** This signal provides informationrmation to the microprocessor on whether a video signal is available on the SCART2 AV input and output port (only for Europe). For sets with an SVHS input it provides the additional informationrmation if a Y/C or CVBS source is present. The presence of an external Y/C source makes this line 'high' while a CVBS source makes the line 'low'.
- **SEL-MAIN-FRNT-RR** This is the source select control signal from the microprocessor. This control line is under user control or can be activated by the other two control lines.

### 9.7.5 Power Supply Control

The microprocessor part is supplied with 3.3 V and 3.9 V both derived from the 'MainAux' voltage via a 3V3 stabilizer (7560) and a diode.
Two signals are used to control the power supply:

- **Stdby_con** This signal is generated by the microprocessor when over-current takes place at the 'MainAux' line. This is done to enable the power supply into standby burst mode, and to enable this mode during a protection. This signal is 'low' under normal operation conditions and goes to 'high' (3.3 V) under 'standby' and 'fault' conditions.
- **POWER_DOWN** This signal is generated by the power supply. Under normal operating conditions this signal is 'high' (3.3 V). During 'standby' mode, this signal is a pulse train of approx. 10 Hz and a 'high' duration of 5 ms. It is used to give information to the UOC about the fault condition in the Audio amplifier supply circuit. This information is generated by sensing the current on the 'MainAux' line (using voltage drop across R3564 to trigger Q7562). This signal goes 'low' when the DC-current on the 'MainAux' line exceeds 1.6 - 2.0 A. It is also used to give an early warning to the UOC about a power failure. Then the information is used to mute the sound amplifier to prevent a switch off noise and to solve the switch-off spot.

### 9.7.6 Protection Events

Several protection events are controlled by the UOC:

- **BC protection**, to protect the picture tube from a too high beam current. The UOC has the capability of measuring the normal back level current during the vertical flyback. So if for some reason the CRT circuit is malfunctioning (i.e. high beam current), the normal black current will be out of the 75 µA range, and the UOC will trigger the power supply to shut down. However, this is a high beam-current situation, the TV screen will be bright white before the set is shut down.
- **$I^2$C protection**, to check whether all $I^2C$ IC's are functioning.

In case one of these protections is activated, the set will go into 'standby'.

The 'on' and 'standby' LEDs are controlled via the UOC.

## 9.8 Abbreviation list

| | |
|---|---|
| 2CS | 2 Carrier (or Channel) Stereo |
| ACI | Automatic Channel Installation: algorithm that installs TV sets directly from cable network by means of a predefined TXT page |
| ADC | Analogue to Digital Converter |
| AFC | Automatic Frequency Control: control signal used to tune to the correct frequency |
| AFT | Automatic Fine Tuning |
| AGC | Automatic Gain Control: algorithm that controls the video input of the featurebox |
| AM | Amplitude Modulation |
| AP | Asia Pacific |
| AR | Aspect Ratio: 4 by 3 or 16 by 9 |
| ATS | Automatic Tuning System |
| AV | External Audio Video |
| AVL | Automatic Volume Level |
| BC-PROT | Beam Current Protection |
| BCL | Beam Current Limitation |
| B/G | Monochrome TV system. Sound carrier distance is 5.5 MHz |
| BLC-INFORMATION | Black current informationrmation |
| BTSC | Broadcast Television Standard Committee. Multiplex FM stereo sound system, originating from the USA and used e.g. in LATAM and AP-NTSC countries |
| B-TXT | Blue teletext |
| CC | Closed Caption |
| ComPair | Computer aided rePair |
| CRT | Cathode Ray Tube or picture tube |
| CSM | Customer Service Mode |
| CTI | Colour Transient Improvement: manipulates steepness of chroma transients |
| CVBS | Composite Video Blanking and Synchronisation |
| DAC | Digital to Analogue Converter |
| DBE | Dynamic Bass Enhancement: extra low frequency amplification |
| DBX | Dynamic Bass Expander |
| D/K | Monochrome TV system. Sound carrier distance is 6.5 MHz |
| DFU | Direction For Use: description for the end user |
| DNR | Dynamic Noise Reduction |
| DSP | Digital Signal Processing |
| DST | Dealer Service Tool: special remote control designed for dealers to enter e.g. service mode |
| DVD | Digital Versatile Disc |
| EEPROM | Electrically Erasable and Programmable Read Only Memory |
| EHT | Extra High Tension |
| EHT-INFORMATION | Extra High Tension informationrmation |
| EU | Europe |
| EW | East West, related to horizontal deflection of the set |
| EXT | External (source), entering the set via SCART or Cinch |
| FBL | Fast Blanking: DC signal accompanying RGB signals |
| FILAMENT | Filament of CRT |
| FLASH | Flash memory |
| FM | Field Memory |
| FM | Frequency Modulation |
| HA | Horizontal Acquisition: horizontal sync pulse coming out of the HIP |
| HFB | Horizontal Flyback Pulse: horizontal sync pulse from large signal deflection |
| HP | Headphone |
| Hue | Colour phase control for NTSC (not the same as ‘Tint’) |
| I | Monochrome TV system. Sound carrier distance is 6.0 MHz |
| I2C | Integrated IC bus |
| IF | Intermediate Frequency |
| IIC | Integrated IC bus |
| Interlaced | Scan mode where two fields are used to form one frame. Each field contains half the number of the total amount of lines. The fields are written in “pairs”, causing line flicker. |
| ITV | Institutional TV |
| LATAM | Latin America |
| LED | Light Emitting Diode |
| L/L’ | Monochrome TV system. Sound carrier distance is 6.5 MHz. L’ is Band I, L is all bands except for Band I |
| LNA | Low Noise Amplifier |
| LS | Large Screen |
| LS | Loudspeaker |
| LSP | Large signal panel |
| M/N | Monochrome TV system. Sound carrier distance is 4.5 MHz |
| MSP | Multistandard Sound Processor: ITT sound decoder |
| MUTE | Mute-Line |
| NC | Not Connected |
| NICAM | Near Instantaneous Compounded Audio Multiplexing. This is a digital sound system, mainly used in Europe. |
| NTSC | National Television Standard Committee. Colour system mainly used in North America and Japan. Colour carrier NTSC M/N = 3.579545 MHz, NTSC 4.43 = 4.433619 MHz (this is a VCR norm, it is not transmitted off-air) |
| NVM | Non Volatile Memory: IC containing TV related data e.g. alignments |
| OB | Option Byte |
| OC | Open Circuit |
| OSD | On Screen Display |
| PAL | Phase Alternating Line. Colour system mainly used in West Europe (colour carrier = 4.433619 MHz) and South America (colour carrier PAL M = 3.575612 MHz and PAL N = 3.582056 MHz) |
| PCB | Printed Circuit board |
| PIP | Picture In Picture |
| PLL | Phase Locked Loop. Used for e.g. FST tuning systems. The customer can give directly the desired frequency |
| POR | Power-On Reset |
| Progressive Scan | Scan mode where all scan lines are displayed in one frame at the same time, creating a double vertical resolution. |
| PTP | Picture Tube Panel (or CRT-panel) |
| RAM | Random Access Memory |
| RC | Remote Control handset |
| RC5 | Remote Control system 5, signal from the remote control receiver |
| RGB | Red Green Blue |
| ROM | Read Only Memory |
| SAM | Service Alignment Mode |
| SAP | Second Audio Program |
| SC | Sandcastle: pulse derived from sync signals |
| S/C | Short Circuit |
| SCAVEM | Scan Velocity Modulation |

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| SCL | Serial Clock |
| SDA | Serial Data |
| SDM | Service Default Mode |
| SECAM | SEequence Couleur Avec Memoire. Colour system mainly used in France and East Europe. Colour carriers = 4.406250 MHz and 4.250000 MHz |
| SIF | Sound Intermediate Frequency |
| SS | Small Screen |
| STBY | Standby |
| SVHS | Super Video Home System |
| SW | Software |
| THD | Total Harmonic Distortion |
| TXT | Teletext |
| $\mu$P | Microprocessor |
| UOC | Ultimate One Chip |
| VA | Vertical Acquisition |
| VBAT | Main supply voltage for the deflection stage (mostly 141 V) |
| V-chip | Violence Chip |
| VCR | Video Cassette Recorder |
| WYSIWYR | What You See Is What You Record: record selection that follows main picture and sound |
| XTAL | Quartz crystal |
| YC | Luminance (Y) and Chrominance (C) signal |